SCIENCE EDUCATION

Formerly GENERAL SCIENCE QUARTERLY

SERVING TEACHERS IN ELEMENTARY SCHOOLS,
JUNIOR AND SENIOR HIGH SCHOOLS, COLLEGES,
AND PROFESSIONAL SCHOOLS FOR TEACHERS

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CONTENTS

Introducing the Contributors 232

Glimpses into German Schools ..... *Agnes Snyder* 233

Curriculum Planning for the Elementary Schools of Pennsylvania ..... *Leversia L. Powers* 238

Curriculum Planning for the Elementary Schools of New Jersey ..... *Myrtle M. Townsend and Dorothea M. Wein* 242

Starting from Scratch ..... *Serena Foley Davis and Helen Dewey Ross* 245

Trends in Science in Childhood Education as Indicated by Educational Research ..... *Katherine E. Hill* 251

Preparing Critic Teachers to Supervise and Teach Elementary Science ..... *George Greisen Mallinson* 254

First Grade Concepts of the Moon ..... *George W. Haupt* 258

A Search for World-Friendship through Science ..... *Irmgard Schultze* 262

The Setting of Science in the Elementary Program ..... *Daisy Parton* 267

Using Visual-Sensory Aids in Teaching Science in the Primary Grades ..... *Helen E. Boer* 272

The Science Content of Basic Readers ..... *John G. Read* 279

Abstracts 283

Book Reviews 288

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(The Contents of SCIENCE EDUCATION are indexed in the Education Index)

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GLIMPSES INTO GERMAN SCHOOLS

AGNES SNYDER

The Bank Street Schools, New York

DURING the fall and winter of 1946, work in The Education and Religious Affairs Branch of the U. S. Military Government in Germany gave me the opportunity of visiting elementary schools and schools engaged in the education of teachers for the elementary schools of Germany. Except for a week in the British Zone, my visits were confined to schools in the U. S. Zone. In all, I observed 34 classes in teacher education institutions and 28 in elementary schools. While, therefore, what I have seen is at best a sampling, I have tried on the basis of my contacts with American educators in Germany and German school officials, to confine the glimpses that follow—excerpts from my diary—to what I think may be regarded as typical. The grouping of the excerpts is made on the basis of what I believe to be the conditions, favorable and unfavorable, that make "the denazification, demilitarization, and democratization of German education" at once so difficult and so challenging.

Housing. School buildings had been lost, not only by bombing, but by having had their use diverted to other needs—as refuge for displaced persons, as hospitals, as quarters for troops. Rebuilding has been to date practically out of the question, and lack of materials has made even the most basic repairs move slowly. The excerpts that follow attempt to show something of the varied problems that must be met, the makeshift measures that of necessity must be taken and, by implication, the human factors involved:

The students of The Paedagogische Institut were assembled in the kino (motion picture theater). Their own spacious building on a nearby hill was still being used by Displaced Persons. Only one bulb in the ceiling of the kino lighted the part of the building in which the students sat. There were two other bulbs back under the balcony, but these did the students no good. There were lighting fixtures, too, on the walls, but there were no bulbs. Bulbs are very scarce.

We visited a state training school for teachers housed temporarily in a convent. The nuns to whom the buildings belonged had their own teacher training school, a boarding school for girls, and a day high school. A group of buildings enclosed a garden. It all looked very old, peaceful, and far removed from worldly din. But it had been bombed. One bomb had dropped right through the roof and floor of the music room. Repairs had been made, and a glazier was putting glass into the windows while we were there.

Two schools were combined in one building since the building occupied by one had been too seriously bombed for use. It was pretty bad—dark halls because windows had been boarded up, plaster out of ceilings to such an extent that I found myself looking up wondering when the next piece would fall. Dreary, gray, dingy, drab—everything.

The Paedagogische Institut (teachers college) was undergoing repairs. The burgermeister and three members of the school board went about the building with me showing interest and pride in what had been achieved. The director showed me the cozy kitchen and dining-room and the two large rooms he expected to convert, one into a gymnasium and the other into a recreation room. He took us out past the cottages that some day he hoped would be used as student residences. Then he took us to the Bunker which was now in the process of being renovated for use as a men's dormitory. We went down into the earth

by way of well-constructed concrete steps. To the left of a hall immediately at the foot of the steps was a room containing several large motors and with meters on the walls. Everything was in perfect condition. Leading off the hall were many rooms equipped with water and electricity, each one of which could comfortably house four or five students. At intervals there were radiators in all the rooms. I asked about the heating system and was taken farther down into the earth to the furnace room. The Bunker had been built by the Germans as a First-Aid station, but later during the war had been taken over by Krupp.

The Volksschule had been housed, after the original school house had been bombed, in a fifteenth century monastery. Two-story gray stone buildings with steep sloping roofs and dormer windows enclosed a cobbled court-yard. The children had been playing outdoors and were now lined up to go inside. I followed them up the dark, narrow, wooden stairway to the second floor and tried not to think of what that stairway would be like filled with smoke and flames.

The completely bombed-out school formerly occupied was across the street from the old house the school is now occupying. We went up narrow wooden steps. On the right side of the first flight was a rail, a temporary one so frail that it shook as I placed my hand on it.

I visited a teacher training institution "in the making." It was not yet occupied, but there was much activity by way of preparation. The building dated from the year 802, I was told, when it had been founded by Augustine monks who occupied it until 1803. Then the state took over until 1880 when it became a Franciscan cloister. During World War II it had been occupied by German soldiers, then by a hospital, next by American soldiers, and finally by 400 Displaced Persons. Renovation had to be fundamental, but the building was taking on an air of cleanliness and order.

Materials. School materials, like all other materials, are seriously lacking. Even the most common supplies—pencils, paper, ink, chalk—are at a premium. Textbooks are only slowly being developed. Shut off as the German teachers have been for so long from the educational thinking of the rest of the world, even if the facilities for production existed, the adequacy of the output for a democratic education would be doubtful. As the following excerpts indicate, in the matter of materials, as in housing, the human factor plays a large part in determining how the emergency is being met.

I visited a tenth grade English class that had had English since the sixth grade. Not having any books, the teacher had been teaching English mainly by reading to the children. When I came in, the class was discussing the part of Katherine Mansfield's *The Doll House* that the teacher had just read to them. The discussion was entirely in English and showed that the class had gained a very good command of the language.

All morning the children had sat in their double desks—60 children in the first grade! The young teacher struggled valiantly to hold their attention to the reading, writing, and arithmetic she was trying to teach them. The children had no books. The reading was done from the blackboard. Some had slates and copied their letters from the board. When the children grew too restless, the teacher brought them back to quiet by dramatically telling them a fairy tale. I asked her if there was nothing at all the children had to work with. She said, "Yes, I have had some match sticks for them to lay out their letters."

We noticed two girls poring studiously over their notebooks. I asked them what they were doing. They told me they were learning how to make a buttonhole.

As soon as the students were seated for lunch one of the students went to the front of the room and read the daily newspaper aloud. The teacher seated beside me explained that the school received just one copy of one newspaper, and this was the only way they had thought of for keeping in touch with the world.

The first thing that struck me when I came into the building was the absence of the prevailing double desks. I had seen them in practically every school I had visited—for all ages of children and for adults, all the same model. Eight or ten of them screwed down to a platform, there was nothing to do with them but have them in straight rows from which students could see only the backs of the heads of other students. But in this school it was different. Here students were seated at tables, working, talking, and studying together. How had it happened? I asked the director. He told me that the original teacher training institution had been evacuated to give place to a Hitler Youth organization, that during the war a war materials manufacturing organization had moved in. None of the original furniture had been left—and the director who was also on the city council, as he said with a wink, had had new tables and chairs made.

I met a teacher of botany at the Paedagogische Institut. She told me that she had written a textbook on botany and had submitted it to the textbook committee. She has also written a book in science for eighth grade children—*The Sunny Side of the Street.* She said she was hampered in her work by the lack of tubes for her bicycle since this meant walking a long way on her field trips.

In a second grade room I saw an attempt at using available materials constructively—horse chestnut and tooth picks out of which little dolls had been made. There were no books.

In a kindergarten the teacher opened a closet to show me the equipment. There were one

drum, a set of Froebel's gifts, and some small doll furniture made by the teacher. I asked if she had any tools. She said she had one hammer for her use—that the children were too young to use a hammer. There were forty five-year-olds in the room. Their day is from nine to twelve and from two to five. The teacher had no assistant. And practically no materials.

I visited a Berufschule (vocational school). In the absence of books, materials were mimeographed and given, sheet by sheet, to the students. Because there were no materials for shop, only theoretical work at present was given—the history of the vocation in which the student was interested, and basic mathematics and science.

I entered an old white-washed farm house. Inside I found a large classroom. I counted the children—86 ranging from first to eighth grade. The school superintendent of the district, not being able to procure teachers, was doing all the teaching himself. I looked around for equipment and noted that there were maps and charts on the walls, a stuffed squirrel and a stuffed crow. The children were writing the story of *The City Mouse and The Country Mouse* which they had seen in a film procured from one of the film distributing centers now being reopened.

For a first-grade class of 45 children, there were 13 beginning readers. But each child had a book, because the teacher supplied the remaining 32, carefully making the books by hand and lettering the text so well that the hand-made books were far lovelier than the manufactured ones.

Food. Both German officials and the U. S. Military Government have worked valiantly to see that the children, in particular, are fed as nearly as possible at least a subsistence diet. "Feeding centers" have been set up to make sure that school children get a hot dish of some kind daily. But, in Germany, as in all war-devastated countries, there are many hungry teachers teaching hungry children.

Forty kindergarten children were seated in a large circle. They were perfectly quiet while the teacher with a can of a malted milk mixture poured out a teaspoon for each child. It was something to watch their faces turned upward with their mouths open waiting for the teacher to pour the mixture. They were eating heavy dark break that they had brought with them.

The director showed us the kitchen. There was a big cylindrical stove and cooking pot all in one. Inside the pot a grayish-colored soup was cooking. The director asked me if something could not be done to get more food for the students—they simply did not have enough to eat.

The director took us to the kitchen-dining room suite. The dining room had tablecloths on the tables and flowers on each table. The kitchen had a cheerful big black cook stove in which a coal fire was burning. There were pots on top in which food was being cooked family fashion. It was all very cozy.

I saw a doctor examine some undernourished children attending a volksschule. In their clothes they did not look too bad. But when their clothes were taken off, their bodies were pitiably thin. Only one child had an undershirt on. The rest, just cotton shirts. And the building was cold. All except one were undersized for their age.

I was invited to have lunch in the dormitory with the students. The room was bare—white-washed walls, bare floor, bare tables. On the tables were heavy white soup plates, a fork and spoon at each place, and in the center a big pot of soup and a big pan of what I thought was a meat pie of some sort. We had the soup—heavy, thick and green. Then we dug into the pan. It was not the main dish as I had thought—the soup was that. The pan contained the dessert—cut up apples and barley covered with a dark pie crust, all unsweetened.

I visited a fourth grade. On the side of each desk there was a tin can with a spoon in it in which the children get their lunch from the central feeding kitchen. Lunch for this class came at the close of the lesson I had observed. When the teacher told the children that it was time for lunch, they all wanted to dash at once. Indeed, though the room was cold and the air heavy and stale, and the children were pale, they were natural and lively. I went with the children to the central kitchen from which 3,500 children were fed. In some cases the children came to the kitchen, had their cans filled and carried them back to their classrooms and ate there. In still other cases, large cans of food are drawn on hand carts to the schools. The kitchen was a dark shed without windows. There were stoves with galvanized pots built in. The food this day was a pudding of cake cooked in milk with a little sweetening. I asked if there were ever children who refused to eat. This, I was told, was unheard of.

Teaching and Teachers. Through the denazification process, about 50 per cent of the teachers were debarred from teaching. Those left were, for the most part, the very old. Immediately at the beginning of the Occupation, steps were taken to recruit young people as teachers. Some were placed at once in the schools and trained on the job as school helpers; others were given emergency training courses of three months, six months, or a year in length with the understanding that they would complete their training later. Others were placed in teachers colleges for two-year courses.

Working with little or no equipment, often in cold, crowded classrooms, it was a matter of constant amazement to me to see how young and old alike lost themselves in the enthusiasm of teaching and how, invariably, they came before their classes well-prepared.

Authoritarian, teacher-controlled, drill-dominated, formal, as most of it was, there still could be seen traces of the educational reforms of the Weimar Republic.

A class of 40 fifth grade girls was having a language lesson. There was a list of verbs on the board—gehen, springen, laufen, klettern. The children were suiting the action to the word—going, jumping, running, climbing.

To illustrate *klettern*, a child jumped up on her desk, wound her legs around a post, and began to climb up it. There was much gay laughter. Of course the action was accompanied by drill of the different forms of the verbs used.

I visited a class in English in a teachers college. As I entered the room, the teacher's voice rang out: "Shall we sing, please?" Whereupon the class fairly burst out in song, "Pack Up Your Troubles in an Old Kit Bag and Smile, Smile, Smile!" The song was followed by the recitation by one of the students of Masefield's *Roadways*. All this was introductory to the main topic of the session, namely, a discussion of Priestley's, *A Visit to a Northern Mining District*. No one but the teacher had ever seen a mine and she but once, long ago. There was an animated discussion of Priestley's suggestion that since mining is such hard work, everybody be conscripted to do his share, just as in the army in time of war.

I heard a professor in a class in Pedagogy explain the difference between "Organic and Inorganic education." The first, he said, was illustrated by the teachings of Pestalozzi; the second, by National Socialism. In the first, development came from within, by the gradual development of understanding by the individual; the second was imposed from without the individual.

A fourth grade was engaged in copying rules of behavior from the blackboard to their slates: "Rules: Come punctually to school. When you come into the room, say, 'Grüss Gott.' Do not talk. Be quiet. Obey your teacher."

A second grade was having a very cheery discussion on what happens to trees in winter—how the ground freezes, no more water for the trees to take up in their roots, the drying of the leaves, etc.

A reading lesson was in progress. The Sister in charge said that their only books were Bible stories. The books were the usual kind I see everywhere—cheap paper, line drawing where once there was color. The children read orally very well. The story was, "Joseph and His Brethren." Each of the stories illustrated one of the Ten Commandments given at the end. At the end of this story the commandment was, "Thou shalt not kill." The children were about seven years old.

The sister in charge of the class showed me some drawings the sixth grade had made. To my amazement, they were drawings of graveyards showing graves with tombstone bearing inscriptions: "Here rests my mother, or my brother, or my aunt." She showed me a small sand table in the corner of the room laid out in the same way as a graveyard. She explained that children did this on All Souls Day!

I observed an eighth grade lesson on the manufacturing centers of Germany. As the teacher sketched a map on the board and placed manufacturing centers in relation to physical features, the boys in the class copied the teacher's drawing in their note books. The reason for the location of the cities with reference to the land features and sources of supply was brought out. There was no reference to either the present or the future of the cities, no word of their destruction, of the paralysis of the industry which once had enlivened them.

I visited a Catholic training school for teachers. The building was well preserved, and had in it both classes for students and an elementary demonstration school. I was taken to the gymnasium to see a fifth grade having a dancing lesson. The teacher, a sister, was some distance from me as I entered the room. She walked toward me, the picture of grace, strength, and vitality. Soon all sprang into action. The nun in her long black garb, full skirts, a crucifix hanging from her waist, stiff white head dress, leaped, ran, jumped across the floor as if she were on springs, and her joyousness was reflected in the children. When she told the children that it was time to leave, there was a spontaneous groan of protest.

A young school helper was teaching arithmetic to a class of 36 boys in a second grade. The teacher gave number combinations, and the children gave the answers and wrote them on the blackboard, each digit in the appropriate square on the blackboard ruled permanently for the purpose like cross-sectioned paper. I asked her if she taught the children arithmetic in relation to their need for it. She said, "Oh, yes, but first they must learn the combinations."

The Problem. It is the policy of the U. S. Military Government to give as much responsibility as possible to the Germans in reorganizing their educational system. The Military Government must approve the opening of the schools, curriculum, textbooks, and personnel, and retains the right of veto. But every effort is made to encourage initiative on the part of the Germans in attacking their problems. A cen-

tral office in the U. S. Military Government in Berlin coordinates the work in the three states of Bavaria, Wuerttenberg-Baden, and Greater Hesse, the American sector in Berlin, and in Bremen. Each of these has an office, set up along the same lines as that of the central office in Berlin, which negotiates directly with the German ministries of education. Each of the other occupying powers has a comparable set-up in its zone. The four powers have had educational representatives in the Allied Control Council who attempt to reach agreement on matters of major educational policy. Similarly the four sectors in Berlin have been represented educationally in the Kommandatura of that city.

There are three million children and youth in the schools and colleges of the U. S. Zone, Germany. There are, at the most, 72 U. S. education officers, supplemented by short-term visits of specialists, to work with the Germans on the task of "denazification, demilitarization, and democratization" of their educational system. The problems faced by this little group cover the whole range of problems faced by any group of administrators, but the conditions under which they are faced are as baffling as they are unprecedented.

To house the schools when one-fourth of them has been bombed out and the school population, due to the rising birth rate and the influx of refugees, was in itself no small administrative task. But when rival claims for the buildings that were left were pressed with such insistence, and, often, such legitimacy, a fine-balanced sense of values was also needed. I recall one day while conferring with a military government officer in a small town, how an excited German school principal burst into the office to exclaim that his school was being taken away from him by UNRRA to house displaced persons, an overflow from the camp on the outskirts of the town. We went to the camp to see just what the conditions were. Much as I hated to see the school closed, the sight of that mass of humanity herded into one large room convinced me that it had the greater immediate claim.

Using this makeshift and that, combining schools that had occupied at one time often as many as four buildings into one, endlessly searching for rooms and more rooms, the work has gone on and children have been returned to school. In Bavaria, for example, the 21,700 elementary classrooms of 1938, reduced to 14,000 by 1945 had reached 17,000 in 1947. But how inadequate this gain is can be sensed when we compare enrollment figures for these years: 900,000 in 1938; 950,000 in 1945; and 1,200,000 in 1947.

The problems of equipment are similar. For not only is equipment, like housing, lacking, but what there is has to be hunted for and allocated against many rival claims. This is particularly true of paper and furniture. Both are needed everywhere. A recent report states that the allocation of paper during the past twelve months has been sufficient to meet just 18 per cent of the requirements for textbooks. Thus far, about four and a half million books have been printed, or 1½ per child.

Serious as the physical problems are, problems of personnel are even more difficult to meet. To face a situation with a staff depleted by at least 50 per cent would be difficult for any administrator, but to have to face this while struggling with the physical problems of housing, equipment, etc., is, indeed, disheartening to the most courageous. Literally, in the early days almost anyone willing to teach was pressed into service. But very soon the training process was begun. Experienced teachers, after a full day's teaching of their own, would remain additional hours to induct the inexperienced into at least the practical aspects of teaching. Short courses, long courses, study groups, every variety of method comparable to the variety of buildings housing the schools, was used. Here, too, there have been achievements. By the middle of 1946, forty-two teacher training schools had been reopened or created

anew. By July 1, 1946, there were 24,732 teachers at work in the classrooms, a number that, however, meant an average of approximately 83 children per teacher and an estimated shortage of 11,140!

Figures, however, give only the more obvious aspects of the problem. To get buildings reopened, and to establish training programs are merely the preliminaries to the major problem. For what must be accomplished, if all that has been done is to serve its purpose, is to promote a new outlook, to change defeatism into constructive effort, to restore self-respect. It is now generally agreed that Germany must become economically self-supporting, that to leave Germany an economic vacuum in the heart of Europe would spell economic disaster to all of Europe. To leave Germany an intellectual and spiritual vacuum would likewise spell intellectual and spiritual disaster of the widest consequence.

I have seen the potentialities for the spiritual and intellectual restoration of the German people in the enthusiastic devotion of the German teacher in the classroom. Outside the classroom the German teacher is often hopeless, listless, but when at work with children, he or she—there are more women teachers now than before in Germany—forgets himself and his troubles in his interest in children. This devotion to teaching is the great hopeful factor in the situation.

A long, uphill road lies ahead. Shut off from the rest of the world for more than a decade, the advances made in the understanding of children and its application to teaching is almost totally unknown. In a large part of Germany, too, there is little recognition of the lack of democracy in the two-track structure of the German school system by which children are separated at the end of the fourth grade, about 10 per cent going on to the secondary school, and thence, to the University, while 90 per cent continue in the Volksschule, to the Berufschule, and to a trade. Here, too, strides are being made through the new constitutions of the states which have made modifications in this system, but there must be conviction about the rightness of such modifications before they will be truly effective. There is little recognition, either, in the prevailing paternalism of the German teacher of that give-and-take in child-teacher relationships which is the foundation of the building of the concept of democracy. All this can be only slowly and often painfully, learned.

It is a very serious responsibility that we as a people have accepted in our occupancy of Germany and an even more serious responsibility when we attempt to influence its educational system. We have placed ourselves in the front line of the fight for democracy. In doing so, not only is our responsibility great, but our opportunity for demonstrating the values of the democratic processes is equally great.

CURRICULUM PLANNING FOR THE ELEMENTARY SCHOOLS OF PENNSYLVANIA *

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A GENERAL demand from the field for more up-to-date course of study material has motivated the current State-wide program of curriculum revision in Pennsylvania.

THE PHILOSOPHY AND ITS INFLUENCE ON WORK PLANS

A philosophy of curriculum-making is developing in Pennsylvania which indicates increasing acceptance of two beliefs: (1)

* Based upon the curriculum revision work outlined in Pennsylvania Department of Public Instruction Bulletin 233-A, "Local Participation in State-Wide Revision of the Elementary School Curriculum." 1946.

The educational needs of youth are rooted in changing conditions and a clearer realization of the social goals of a democracy, and (2) Education is concerned with the all-round growth and development of children. This philosophy means, of course, that the study of the curriculum involves all the experiences of the child, both in and out of school, which the school utilizes to achieve its objective of all-round child growth and development. This concept of a curriculum has sharply differentiated our whole scheme of action from that which would have been appropriate if our concept were that the curriculum is just the course of study.

FUNCTION OF THE STATE DEPARTMENT IN REVISION

We had to clarify our thinking as to just what the function of the State Department is in the whole scheme. It was decided that a state course of study can suggest the general pattern of the curriculum and set forth plans for realizing those needs which are common to all children. It is not identical with the curriculum, however, and should not serve as a blueprint to be used without modification in every local community. Certain specific needs of children vary because of differences in their capacities to learn and because experience backgrounds and types of non-school services offered by communities vary. Hence the curriculum of any local school (that is the curriculum as a course of study *plus* the sum of the children's experiences) must, of necessity, differ somewhat from that of other schools. Constant evaluation and modification of the curriculum should go on in all school units.

I have made these statements about our general philosophy concerning the curriculum and the function of a state curriculum because these two ideas have been basic to every activity in which we have been engaged in our curriculum revision work in Pennsylvania.

FUNDAMENTALS IN A SOUND PROGRAM OF CURRICULUM REVISION

The first task was to set up machinery to promote increasingly six principles which we felt were basic to a sound program.

1. Responsibility for local plans for participation should be placed upon local administrators.
2. Maximum professional and lay participation should be made possible.
3. Local districts should be encouraged to attack directly their own problems with the intent to make measurable or observable the desirable differences in their own teacher-pupil-community-administration procedures.
4. Major emphasis should be placed on the pre-service and in-service teacher-learning aspects of the program and minor emphasis on the eventual production of printed matter.
5. The inter-relationships between the objectives, the ways and means, and the evaluations as a part of any type of problem in the elementary school should be constantly emphasized.
6. The necessity of the curriculum being the determinant of solutions to problems concerning school and community "settings," and all administrative plans should be highlighted.

With these six principles in mind we finally took steps with which I will attempt to deal here briefly. As a point of actual fact, I can assure you that these steps were not as easily carried out as this report may seem to indicate. Not every administrator is "ready" for an honest appraisal of the improvement of elementary education in his own district, by his own teachers, and not every teacher is "ready" to evaluate himself objectively in relation to what is happening to his pupils. I can, however, point with great pride to the hundreds of administrators and the thousands of teachers in Pennsylvania who were more than "ready" for the starting gun.

STEPS IN INITIATION AND GROWTH OF THE REVISION PROGRAM

At the beginning of last school year we issued Bulletin 233-A, "Local Participation in State-wide Revision of the Elementary School Curriculum," which was designed to do three things: (1) to promote study and discussion, (2) to promote im-

mediate experimental application of local plans for improved procedures, and (3) to serve as a guiding framework for basic philosophy and methods of group-work. This bulletin is not intended for a curriculum, but merely for a guide in working on curriculum problems.

We presented the bulletin at a series of sixteen area meetings for administrators. We have felt that this step has been most worthwhile. At each meeting the day was one of study, discussion, and explanation, and was primarily designed to instrument the first of the basic principles just enumerated, that is to place responsibility upon local administrators. These meetings were held at the teachers colleges and universities with an eye also to furthering the fourth principle—that of teacher education.

Wherever there has been interest, direct and continued contact has been maintained by the Division of Elementary Education with local groups through meetings which they themselves planned, through County Institutes, through local and area meetings of the Pennsylvania State Education Association, and through teachers' meetings in independent districts. These meetings have been keyed to the local plans, since districts are each progressing at their own rate from their own points of readiness.

In every contact we have emphasized and re-emphasized that any curriculum revision results are only as good as the actual desirable differences that are thus brought about in the lives of the children. We have, therefore, encouraged all groups to tackle concurrently one of their own specific problems and to read and study in the general field of that problem so that they may "lift their sights" as they "plow their fields." Briefly, about twelve thousand teachers in approximately eight hundred groups, are now working under their own leaders on their own problems. In one year's time 72 per cent of our counties have initiated county-wide organizations, 50 per cent of our independent districts have going organizations and practically every teacher education institution is involved in an effort to study the needs of Pennsylvania's elementary schools and to follow through with actual improvements, in whatever relationship to this program they see as theirs.

USE OF THE MONTHLY NEWSLETTER

Another activity which we have found helpful is the publication of a monthly *Curriculum Development Newsletter*. This letter is designed to facilitate intercommunication of groups and to keep the field informed concerning local activities. We have also issued suggestions and guide sheets from time to time as problems have been highlighted.

Bulletin 233-A has served to focus attention upon the last two of these six basic principles—No. 5, the need for directly inter-relating the objectives, the ways and means, and the evaluation procedures, and No. 6, the assumption that there can be no real separation of the problems related to the setting of the curriculum, the administration of it, and its true purposes and content.

Chapters in the Bulletin emphasized equally each of these facets of a good school and we so worded the treatment of all topics as to highlight the relationship of evaluations to objectives.

FOLLOW-UP WORK ON NEXT STEPS

During September and October of 1947, we conducted a series of eleven all-day meetings, to cover the State geographically. These meetings were attended by administrators, chairmen of teacher study groups, people from teachers colleges and lay people. Each day was devoted to a report of progress, a clarification of plans and purposes and to the rather definite planning of next steps.

SCIENCE IN THE ELEMENTARY CURRICULUM

The above summary serves, I hope, to give you at least a background for our consideration of the problem under discussion today—science in the elementary curriculum.

Chapter IV of Bulletin 233-A is devoted

to "the Program of Studies." Under this topic are four major headings, not because we failed to realize their close relationships but rather that no one can consider the whole world at one time, even though everything in it is related to everything else. We chose to consider what one might call the content field under the heading of The Social Living Program. I will come back to that. The other three headings are The Physical Well-Being of the Child, Developing a Skills Program, and Developing Personal Tastes and Abilities. We included the consideration of science under that heading—The Social Living Program.

I quote here certain passages from Bulletin 233-A because they will give you most directly our approach to this problem of science:

"In our modern, complex society, man lives in an environment composed of both people and things. He cannot live to himself alone. Efforts to live harmoniously with other groups of people, in the natural conditions surrounding them, constitute man's major problem of living. Adjustments even to the physical world are predominantly social in nature. It is, therefore, quite fitting to include in the Social Living Program those experiences which traditionally have been separated into the subject matter areas of the social studies and science.

"In a very real sense, the Social Living Program, as herein conceived, includes the very essence of education. It is the core of the school program.

"The primary concern in the Social Living area is the development of those types of pupil behaviors, understandings, and appreciations which are essential for immediate, and later adult, adjustment to life, and the preservation and extension of our democratic way of life. The content of and appropriate methods in the Social Living Area are determined by:

1. An analysis of the types of activities engaged in by people living in a democracy.
2. A discovery of the abilities, habits, traits of character and ways of behavior that are peculiarly demanded for successful citizenship in a democracy.
3. An interpretation of the values by our social order, and the problems citizens face in attempting to realize these values.

"Since it is the point of view of this bulletin that education is concerned, primarily, with the development of personalities that are able to meet effectively the demands of our modern, complex, industrial society, it is imperative for educators to translate these demands into results in terms of understandings, attitudes, behaviors, habits, and abilities. We will have the basis for an effective curriculum in the Social Living area only when the emphasis is placed where it belongs—on the development of appropriate behaviors, rather than on the bare accumulation of certain bodies of subject matter, by teachers awake to their opportunities in and their responsibilities for providing experiences which cannot be gained from books alone."

Among the suggested behaviors listed are an understanding and appreciation of how natural conditions influence life; how people adjust to, control, conserve, and improve the non-human resources; how human resources are conserved—how life is perpetuated and preserved; ability to use the scientific method in the solution of individual and group problems, both of an immediate and more remote nature; and making habitual the use of effective steps in problem solving—recognizing the problem, collecting and organizing pertinent data, arriving at tentative hypotheses on the basis of available data, and revising conclusions in the light of new data.

We are suggesting an expansion of the Social Living Program to include more experiences designed to bring the child into closer harmony with natural forces—ordinarily called science. In dealing with these areas of experience, the program must be concerned not only with giving the child knowledges which are necessary to his understanding of and adjustment to the physical world, but it must be charged with a heavy responsibility of developing the inquiring attitude, the scientific spirit which discards prejudices, notions, and propaganda as suitable evidence for the solution of problems. No other organized subject matter field lends itself so well to this purpose as does science. The scientific spirit, and that method of reasoning are essential to satisfactory solution of individual or group economic, family, religious, civic, health, and recreational problems. The curriculum organization suggested in Bulletin 233-A, with science as a part of the Social Living Program, contemplates a tremendous increase in science experiences in the elementary schools.

PENNSYLVANIA GROUPS WORKING ON SCIENCE PROGRAM REVISION

We now have some thirty groups of interested teachers, most of them in touch with good consultants in this field, working on this problem. At this stage of our progress I cannot tell you exactly what we will have in 233-B and later in 233-C. Bulletin 233-B will be published for 1948–49 and will be the general plan for Pennsylvania's elementary schools. Bulletin 233-C will be an extension and expansion of 233-B and will follow it in approximately two years. I do know, however, at this time that science *will* be included, that it will be included as an integral (and we hope inescapable) part of the whole content field, and that its emphasis will be understandings for better *living*.

We are faced with several real problems. Working out solutions to these problems and making those solutions functional will be long-term programs involving the efforts of the teaching forces of the public schools and the schools of higher education in Pennsylvania. I refer particularly to the proper alignment of the courses in elementary science of our teachers colleges and universities to our needs for teachers who can both teach science content and use the scientific method; the necessity of a planned over-all attack on the re-education of teachers now in service; the real need of re-education of boards of education and the public to an acceptance of these ideas; and to a willingness on the part of boards to provide for this field, particularly in terms of budget.

We have much to do in Pennsylvania. The State program must give enough direction to assure some degree of success to these groups that are struggling not only with curriculum problems but with a new use of the democratic process which is a new technique for surprisingly large numbers of teachers and administrators. The State program must not be rigid or dictatorial. It must itself enhance the techniques of democracy. We believe profoundly that this process is itself invaluable. Although we are just started, we seem to be off to a good start. You people who are specialists in this field will do, I feel sure, all within your power to help us. We need, and, as this program develops, we will continue increasingly to need your advice, your support, and your active participation.

CURRICULUM PLANNING FOR THE ELEMENTARY SCHOOLS OF NEW JERSEY *

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ONE day we stopped in our planning to listen to what New Jersey teachers were saying about science. The teachers are amused now when they identify themselves with this picture of confusion. "I don't know enough about science to teach it." "We have no science course of study." "I tried a science lesson once and my children didn't like it." "My husband says that I don't know anything about electricity." "I have no set of science books." "My children always ask questions I can't answer." "My children already know the name of every tree in the schoolyard." "Even the garage man says that women are motor morons." "It takes the edge off high school science." "My program is too crowded now." "I hate snakes." "I never liked science when I went to school."

In contrast to the above picture, there were many individuals in the state who were ready to contribute to the state pro-

* Presented at the Twenty-First Conference on the Education of Teachers in Science, Teachers College, Columbia University, November 14 and 15, 1947.

gram. The State Department of Education and members of the New Jersey State Science Teachers Association realized their responsibilities in coordinating the work which had been started. When the planning committee met, several important issues were settled.

1. A state bulletin should be prepared to give guidance in planning a twelve-year program.

2. The bulletin must give guidance in developing a program for local areas rather than outline a set course of study to be followed throughout the state.

3. The program must be balanced to include all areas of science rather than be limited to nature study.

4. If the bulletin is to influence thinking and practice, many must participate in preparing it.

5. Some of the objectives for the science program were set up in a diagram like this:

Changed Behavior
Changed Attitudes
Skills
Understandings
Information

How can our science program meet the problems of the scientific age?

No matter how carefully the base of the triangle has been built, the program is worth little unless it leads to changed attitudes and behavior. Skills in thinking, in finding facts and in filtering the facts are important. Understandings grow slowly as children generalize. Children need many facts to solve their problems.

The outline below lists the groups contributing to the relation of each group to the whole.

1. New Jersey State Program.
   - A. State Department of Education and State Science Teachers Association.
     - a. Children.
     - b. Parents and community.
     - c. Teachers.
     - d. Helping teachers and supervisors.
     - e. State university and state teachers.
     - f. Specialists in science education.
     - g. Bookmen and supply companies.

Some of the contributions which each group is making:

1. The children

The children are our most interested participants. Every age level has supplied us with things they want to know:

How can the doctor tell whether you have measles or chickenpox? What will turtles eat? How can dogs hear whistles that we can't hear? Can there be a rainbow without any rain? How can we balance our aquarium? How did the worm get in the apple when there isn't any hole? Why does the ocean come up further on the beach sometimes than others?

Some questions reveal superstitions or misconceptions, such as:

Why shouldn't you eat fish and ice cream? Why doesn't lightning strike twice in the same place?

Teachers are becoming aware of the significance of these questions, and so we are asking them: Which of these replies do you give the children? "Stop asking questions and get to work." "I'm busy just now." "I'll tell you the answer." "Let's find out together."

2. Parents and the community.

Every school will profit by surveying its community resources. One eighth grade listed the people whom children could consult to find answers to their science questions about disease. They listed: Mrs. Goldie Knight, high school science teacher; Charles Dillard's sister, cadet nurse at the Methodist Hospital; Dr. Martin Sanders, school physician; Mr. Underhill, mosquito commission; Dr. Ples Hollowell, Hollowell's Pharmacy; John Paul Ash's mother Ruby who works at the Apple Dairy; our janitor Joe Denbo, who knows about D.D.T.; Martin Heinlein, the butcher; Thomas Cato at the city water plant; Ed Moery at the ice plant.

A group of teachers in one part of the state listed places to visit where they could take teachers from another county in preparation for children's excursions:

In the Philadelphia area, this list included the weather bureau, Gimbel's Test-

ing Laboratory, planetarium, Academy of Natural Science, and Franklin Institute.

In the Trenton area, a group interested in health and medicine made this list: State hospital, penicillin factory, Johnson and Johnson factories, Zoaite and Bayer aspirin factories, Walker-Gordon Laboratories.

A parent study group interested in the kinds of toys to buy for Christmas found two newspaper articles ("Scientific Toys" and "Science, not Santa should choose Toys") and devised this outline for discussion:

What Scientific Toys Are Good for Various Age Levels?

1. What toys teach about mechanics?
2. What toys teach about light and color?
3. What toys teach about heat?
4. What toys teach about sound?
5. What toys teach about chemistry?

3. Teachers.

Our teachers are participating in various kinds of workshops where they work on curriculum materials and experiment in using them with their classes. The most popular types of workshops include:

Two weeks at Trenton State Teachers College in summer without cost and credit.

Fifteen two-hour classes held in the counties from 4–6 after school with undergraduate or graduate credit from the state university. Classes were taught by members of the planning committee.

Two week summer workshops—3 hours a day, with credit from the state university. Workshop held in one of nearby schools.

Three day workshop during the school year, one day for teachers of grades 1–3, one day for teachers of grades 4–6, and one day for teachers of grades 7–8.

Grade group meetings held from 4–8 after school with dinner at school.

Choosing something for their classes to observe helps some teachers to get a start with science. Below are listed some of the plans formulated by the children:

Our Class Tree

We will watch to see:
What colors the leaves turn
When the first leaves fall
When the tree is bare
If any bird's nests are left
If the bark changes color
How big around the trunk is

Using the word "observe" in a broad sense to include many verbs of action, as Mr. Blough has suggested in his science articles in *School Life*, has helped many teachers. Observing means not only watching or seeing, but feeling, smelling, hearing, and tasting.

One group of teachers planned science walks for their classes on various kinds of days. The children listed things to notice on a cold, snowy day; on a foggy day; on a cloudy day; on a rainy day; on a bright, sunshiny day.

Several teachers are building libraries of 2 x 2 kodachrome slides. These pictures which they take of their class activities in science may be shared with other classes. For example one set of pictures shows the class tree at various times of year, another shows methods of mosquito control, another shows gullies before and after a rain.

4. Helping Teachers and Supervisors

A number of the Helping Teachers have found it useful to prepare descriptions of science lessons observed and help the teacher evaluate them according to criteria which they set up cooperatively. This plan has proved very successful in teachers' meetings. The following is a sample lesson and set of criteria:

During a forty-five minute period, a third and fourth grade took a walk around the school yard and looked under the stones. The last minutes were spent in listing the things observed.

Things We Saw Under Stones

1. Ground was wet and soft.
2. Bugs ran in all directions.

3. Bugs under the stone had no color.

5. Criteria for Evaluation.
   1. What planning could have taken place before the walk?
   2. How did the children check their observations?
   3. What would be a good next step?
   4. Were there any evidences of thinking?

The supervisor in one area helped her teachers plan a chart for recording the problems studied by various groups from year to year.

6. Helping Teachers and Supervisors

Helping Teachers and Supervisors are constantly on the alert for practical ideas which will illustrate content that should be included in the state science bulletin.

In science as in all of our curriculum planning we must always keep in mind: "The road to success is always under construction."

STARTING FROM SCRATCH *

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A little over two years ago, a group of eighteen elementary school teachers began meeting together to find ways of providing fruitful science experiences for the children of the elementary schools of our district. Ours was a difficult task for this section of our city is almost utterly devoid of any stimulating source material in either the natural or the physical science area. Furthermore, we who were to seek answers to the problem had as our only qualifications an interest in science, a realization of keen interest on the part of children in things natural and physical, and a hazy memory of the organized science information to which we had been exposed in teacher training courses. We are recording some of our experiences together in the hope that others, desiring to accept the challenge to do something about satisfying children's consuming interest in science, may be encouraged to move forward in that direction.

Feeling insecure in approaching the problem unaided, we secured the services of a consultant. In advance of the first meeting, we prepared a somewhat ambitious agenda which included provision for committee organization, for determining purposes of meeting together not only in regard to self-education, but also in arriving at objectives for children in the area of science. Included, too, were suggested committee activities. As was the expressed hope of the chairman, this agenda served as a point of departure for our thinking rather than as a channeling of activities.

There was unanimous agreement regarding the advisability of helping children develop a scientific attitude and method in attacking a problem. We hoped too that we might help them find joy in the exploration and discovery of their immediate environment. Our consultant expressed the view that through continued meeting, we could develop a reservoir of enthusiasm and increase our knowledge and interest in the area of science. In response to the request that the members of the committee express their thinking as to what they could gain by meeting together, two main questions were raised:

1. Where and when and how do you start science experiences with children?
2. Can a course of study in science be evolved that could be integrated with activities in the area of the social studies?

Our consultant pointed out that if teachers felt inadequate in their background of science experiences, they could allow children to bring things to school and from the children's questioning about these things, science experiences would

* A report of the efforts of a group of elementary school teachers to find answers to the question, "Why science and how?"

come about naturally. He stressed the importance of the scientific method which he explained as being, in essence, trying to find answers to problems.

It was suggested that our consultant could help by telling us about some of his experiences with other teacher groups and what we should want to achieve in science teaching. As an answer to the first request mimeographed copies of a brochure, then in press, "Science, An Approach in the Elementary Schools" was made available to us. This brochure was the result of experiences of teachers in another section of the city. A consideration of basic philosophy and objectives was suggested as the agenda for our next meeting.

As a means of stimulating thinking and discussion, brief excerpts from the writings of experts in the field were sent to the various members in advance of the next meeting. At this next session the following basic ideas were expressed:

1. The value of science in building a greater social consciousness, the start to be made in the natural interest of children in things since an appreciation of the social implications comes later in their development.
2. The value of science in helping children grow in the attainment of a scientific method in the solution of problems, the results being evaluated in terms of modification of behavior.
3. The importance of living with children in such a way as to encourage freely the utilization of the scientific method as an essential in developing real democracy in living.

The need for the application of the scientific method in human relationships was given special emphasis. As one member put it, she would be satisfied if her children gained nothing more than the habit of asking, "why?" when faced with prejudiced opinions or acts at home, in school, or in play.

General agreement was expressed that at the elementary school level science should be an integral part of the curriculum and not be taught as a separate subject and that the scientific method is applicable to the other subjects in the curriculum.

The question was then asked, "How do we start?" Our consultant suggested that we might try to collect a variety of experiences that children could have and that we think of them in terms of maturity ranges. He added that much experimentation in the area needed to be done both by teachers and by children. Carrying his thought forward a member suggested that we collect the science experiences of the children in our respective schools and share them at the next meeting. Another proposed that we start with the kindergarten level and find out:

1. In what things are children interested?
2. How can this interest be utilized for scientific observation?
3. How can this science material modify behavior and attitude?

Another suggested that those of us not teaching at the kindergarten level, do some reading regarding the child from four to six years of age in order that we might be better able to participate in the discussion. Elements of each idea were combined in the final suggestion that the kindergarten teacher on our committee report regarding science activities in her kindergarten and that the rest of us contact the kindergarten teacher in each of our schools, observing in the kindergarten if possible, in order to bring additional suggestions as to possible activities. It was felt that through this approach a larger number of teachers could be brought indirectly into the activities of the committee.

In her introductory remarks the kindergarten teacher described the child of four to six as being self-centered as evidenced by such expressions as "*My* house, *my* blocks, etc." Gradually his interest widens. She pointed out that children at this age like to handle things and ask questions. She stated that school should be the place where things can be handled, where the child's questions can be answered and where his thinking can be directed to help him solve his own problems as they arise.

The experiences of her pupils included: planting indoors and out, observation of seasonal change during walks about the neighborhood, making a terrarium, planning an aquarium, growing bulbs and

sweet potatoes, experimenting with a magnet, observing and caring for pets in the classroom, observing the thermometer, noticing steam coming from the radiator followed by a visit to the heating plant of the school, observing colors in the prism and in soap bubbles, observing the colors in the rainbow, listening to the teacher read about a rainbow from a book, listening to the sound of a seashell, rubbing blocks together, observing a caterpillar weave a cocoon and watching for the emerging butterfly, noting the shapes of clouds, listening to a story about birds and providing a feeding station with water and crumbs on the window ledge for the birds that stay in our locality during the winter, visiting the zoo, learning about pressure with milk straws, learning about evaporation through observing water disappear from a bowl, seeing boiled water go up in steam, and from noting the difference in time required in drying their clothes in the room or on the radiator.

In the ensuing discussion the following challenging questions arose:

1. Does not the teacher have to read a great deal?
2. Are there limits to the science experiences in which kindergarten children can participate?
3. Can the teacher go too far in carrying forward the science experiences of little children? Is there a possibility of overstimulating little children? Can they be carried beyond their depth?
4. Are there certain activities that can be deferred? Are there activities that should not be introduced at a kindergarten level? What can be put down as levels?
5. Could not the answering of little children's questions on a sensory basis serve as an adequate guide?
6. What are children's interests at certain maturity levels?

In the reporting of kindergarten activities in the other schools, great similarity in the types of experiences provided was noted, although it was felt that in this particular kindergarten the experiences had been unusually rich. It was decided that at our next session we try to crystallize our thinking and make some tentative generalizations regarding the teaching of science at the kindergarten level. It was also agreed that we continue similar reporting of experiences by teachers of the first, second and third grade levels. Our consultant offered to send to the member who volunteered to try to put into written form our thinking at this point, his thoughts on the subject in order to assist in the preparation of her statement.

In the statement subsequently prepared by her the following ideas stood out:

1. Science experiences begin very early in the child's life.
2. He is interested in doing rather than in listening.
3. He is inquisitive but there is no logical sequence to his "whys?"
4. The child's pre-school learnings take place largely through first hand observation and trial and error experimenting.
5. The kindergarten should provide an expanding environment.
6. Kindergarten science should be as functional as possible and much of it will arise from random observation and questions. Teachers however should not permit events and discoveries to be a string of disconnected, mundane items.
7. Overstimulation is an easy and natural pitfall for any teacher with imagination and ability. While any question or object brought into the classroom by a child should be explored and interpreted, special emphasis should be reserved for phenomena that occur within the child's small world.
8. Science experiences should be selected and provided for in such volume and with such timing that the child's understanding of the thing involved is more clear cut and vivid than before, not less so.
9. The world of the five and six year old is expanding so rapidly and their curiosity is attached to such an array of phenomena that science in any school situation can be but a sampling of what could be profitably engaged in.

At this point reports were given of the science experiences of the six to eight year olds. The teacher leading the discussion stated that most of the experiences with her group were in the area of natural science and that science books present far too little in the area of physical science. It was also pointed out that while there is not much difference between the interest and activities of the kindergartner and the six to eight year old, the older level seems to be able to make a beginning in the handling of the abstract.

A discussion followed concerning the

conditioning of children, their fears and the mental hygiene aspect of science. A few additional activities as reported from the various schools were given. The question was raised "Does sex influence the interest in science?" It has been said not, but boys seem to be more interested probably because they have been so conditioned by the types of toys provided for them. The question was also asked "Are boys more interested in physical science than girls?"

One of the teachers next told us about the interest of her class of eight and nine year olds in making primitive musical instruments as one phase of a unit on Africa. She stated that her children had also had science experiences with magnets, static electricity and atmospheric pressure as related to a simple barometer, observation of winds and a study of stones in relation to how rocks have formed throughout the ages. The similarity again in interest of the children at this age level with those at the kindergarten level was noted. In fact, we were not quite sure as to the meaning and implication of the scientific approach in the evaluation of these activities. We decided to put that question on the list for our consultant to answer.

As the reporting of activities advanced, we felt the need for further clarification of our thinking, especially in regard to approaches and the scientific method so we sent some questions to our consultant for discussion at our next meeting. He explained the scientific method not merely the stating of facts, but the including of: discussions, leisurely getting familiar with general ideas; playing around under observation; sorting out questions which arise; attempting to answer those selected; introducing material which will help find answers; visiting museums, consulting books, or parents or other persons, and making further observations.

He also stated that we can capitalize on each teacher's individuality. She may be interested in a small area which will impinge on many areas and, although the curriculum may seem unbalanced, the teacher can grow with her class and become an amateur scientist. He stressed again the incidental teaching of science, the need of a repository for objects brought in, and, where they fit naturally, the advisability of bringing them into the lesson. He suggested a lesson on the compass whenever exploration is studied.

At a later meeting, when we reported regarding science activities of the nine to twelve year olds of the district, we learned that some of the common experiences for this age level were: a study of the different types of thermometers and the keeping of temperature charts; study of all phases of weather; getting acquainted with the earth's crust; conservation of forests as a flood preventative; cloud formations; evaporation and crystals; sound waves; light waves; seasonal change; making collections; chemical changes; a study of animals and insects; and learning about time.

A general desire was expressed for us to have an opportunity to observe our consultant conducting science experiences with elementary school children. He acceded to our request, pointing out, however, that demonstrations are never natural situations. He suggested that we agree on some one phase, some such common experience as "balance in nature," an area in which so much illustrative material exists at all levels. We found we knew little about the subject and were glad we had agreed to discuss the subject at our next meeting. In the meantime, our chairman secured copies of "Balance in Nature" by Bertha Parker and sent them to each member of the committee to read in preparation for the discussion.

In his presentation our consultant emphasized that at the lowest levels children should become acquainted with nature becoming increasingly more conscious of beauty and rhythm in the universe, of natural law and unity and they should be inculcated with a feeling for and real love of nature. Some of the ways suggested for furthering these objectives were:

1. Having a terrarium in the classroom, to introduce many types of life.
2. Having and caring for a sanctuary in the school yard such as a tree, a birdhouse, a suet station, etc.
3. Introducing the idea of a food chain, as for example, "cat eats mouse," "mouse eats oatmeal," etc.
4. Building up through stories and excursions the food pyramid idea with scarce animals at the top and plant and animals that are plentiful at the bottom.
5. Making children aware of the lavishness of nature and the reason for this being the high percent of failure to reproduce other plants by themselves.

It was suggested that at the older levels the children could be led to see: the place of man and his relationship to balance in nature; that it rests squarely on man's shoulders; that without nature's rich resources man cannot progress; that national greatness rests upon resources. Because of the older children's ability to see this relationship, he suggested that the topic of "licensing" for fishing, gunning, etc., be introduced to build understanding of the need of government control to help keep the balance in nature and of the necessity of man to practice restraint.

Of value at this older level, was the suggestion that teachers must help build personal responsibility in children in maintaining balance in nature and in seeing the possibility for them to help in preserving and conserving. They must be given opportunities to experience along these lines with such activities being provided as planting trees on a slope being eroded, or filling in deep crevices with brush, weeds, or stones.

We were given many and varied source materials which could be used at all levels of maturity. At the conclusion of the discussion a suggestion was made by one of the group that each of us experiment with the topic of "Balance in Nature" in our own classes.

Our consultant next gave us two demonstration lessons with pupils of different age levels in schools located in different type communities. The first class was composed of thirty-three seven and eight year olds in a 3A class less than a month. Seventy per cent of them were Italian. Of the remaining number, one was a Filipino and the rest were Negroes. The teacher was asked to give a short description of her class before the lesson. She remarked, "Most of them come from underprivileged homes. Their sources of entertainment and information are restricted to motion pictures, radio programs and comic books. Their science experiences have been incidental, having been limited for the most part to the observation of seasonal change. For many of them, fantasy and realism have been so intertwined in terms of "Superman and the Phantom" that their puzzling "whys?" are dismissed by the statement "God caused it."

With this class our consultant discussed weather, since the children had previously raised questions about the ice and snow on the streets at that time. Through many simple and interesting experiences and experiments, he led them to explore their minds, to ask questions, to express their reactions, and to use their bodies in helping to think through the implications in some of the questions asked.

Following the demonstration lesson, we discussed the procedure as to the reactions of the children and evaluated these experiences in the light of environment and social behavior. We, as a group, profited greatly from the observation, as in the demonstration which followed, we could see the unfolding pattern of the elementary steps of the scientific method take form; the problem at hand, the questions asked, the recorded data; the pulling together of all experiences; and the thinking through and formulating of conclusions.

The second demonstration was given with a class of thirty-nine fourth grade pupils, composed mostly of Negro children with I.Q.'s ranging from 66 to 120 and ages ranging from nine to thirteen. The children had become aware in a social studies overview unit, of the close link between farming, quarrying, and lumbering, and the earth itself. From this observation

arose innumerable questions, such as, "How was the earth made?", "What makes little stones crack?", "Why are there different kinds of stones?", "What makes the minerals in the earth get hard?" This led to a study of rocks and stones. Our consultant carried on with this area. The children were fascinated in discovering that some rocks which they had brought in were smooth, some rough, some hard, some soft, and that it takes a long time to break some stones even if they are hit hard and continuously with a hammer. They experimented with exposing stones to hot and cold water, and with trying to dry rocks off after they had been wet, etc.

Through repeated experiencings and experimenting, the children each with their limited backgrounds, were being stimulated to keener observation and a widening viewpoint. Their teacher reported to the committee later in the term, that her class had become definitely aware of the following concepts:

1. The earth is much bigger than we thought.
2. The earth is of great help to man in providing his needs.
3. It is very old.
4. It is constantly changing.

As we met together for the last time of the year, the question which was uppermost in our minds was, "What is our next step?" It was unanimously agreed that we wanted to continue having and sharing common experiences and thereby to continue to grow in our science background.

The following year many of the members of the group attended the In-Service Workshop classes in the conducting of simple science experiments and the constructing of inexpensive equipment. Incidentally, one of our number was chosen as leader of the course. Some of the group were able to avail themselves of the opportunity afforded during Schoolmen's Week of attending a series of unusually fine, overall programs in science in the course of which basic philosophy was developed, simple experiments were demonstrated and a simulated broadcast was used to show how dynamic a force the radio can be in developing interest and understanding in science. The growth of the individual members in the group was evidenced when three of our number made real contributions in this program. A report of the entire science program of Schoolmen's Week was made available to the members of our science committee. In addition to taking advantage of incidental opportunities for personal growth, the members of the committee planned with the educational directors of the Academy of Natural Sciences and Franklin Institute for a series of lessons on seasonal change (at the Academy), and on the subject of Time (at the Institute). Through these experiences we learned how the institutions might serve not only in promoting teacher growth but in providing source material lessons with teacher-pupil groups.

As was stated in the beginning, our principal objective in recording our experiences in the search of self security in the area of science teaching in the elementary school, was the hope that others might be encouraged to move in the direction of broadening their knowledge and understanding. We were especially fortunate in being located in a city rich in institutions of higher learning, in institutions devoted to both the natural and the physical sciences and in being provided with a consultant to help us find answers to our questions. We believe, however, that any group of interested teachers without background and far removed from scientific institutions, could move ahead by meeting together, by pooling their thoughts in group discussions, and by trying out science activities at various maturity levels and sharing these experiences with one another. In lieu of consultant service, reading in the field might help. The local school authorities, if they were made cognizant of teacher needs, might provide consultant service for a week or a day or at widely spaced intervals. Leadership for organizing the group could come, as it did with us, from the group itself.

TRENDS IN SCIENCE IN CHILDHOOD EDUCATION AS INDICATED BY EDUCATIONAL RESEARCH

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WE are, as a group of educators interested in science teaching in the elementary school, really beginning to consider the importance of the child. From time to time, there has been such a consideration to a degree. But, for the most part, we have first considered the field of science as such and the adult's point of view toward science. At times we have been on the point of exploiting the child rather than first considering the child and then considering science in relation to him. For example, during the nineteenth century in this country some instruction in science was to be found in the elementary schools. The purpose of this science instruction was, however, to teach adult moral standards. At the beginning of this century science instruction in the elementary school was influenced by the Industrial Revolution. There grew up in our schools a Nature Study movement, one purpose of which was to entice children to remain on the farms of our country. Such goals as these, the teaching of morals and the encouragement of the production of food and clothing materials, seem to be adult-centered.

About 1920, science educators began to express a more vital interest in children. They began to view science instruction as a means of satisfying the present, not the future, needs of children. It was realized that children are members of a democracy, that they do not wait until they are twenty-one years of age to participate in a democracy. We began to see more and more clearly that we were concerned with children who are not being prepared for participation in a culture but who are now participating actively.

KNOWLEDGE GAINED FROM THE FIELD OF CHILD DEVELOPMENT

With such ideas in mind, it is apparent that we must know children before we can know science instruction in relation to children. Research in the general field of child development gives us our basic knowledge of children. Research in this area begins with the infant and continues on through to the study of the mature individual.

Some of the most recent research stems from such groups as the Child Development Institute at Teachers College, Columbia University, the Yale Clinic under the guidance of Dr. Arnold Gesell, laboratories at such state universities as Iowa, Minnesota, Wisconsin and Ohio, and, even more recently, at the Mayo Clinic. The findings of these and other groups have given us information concerning the child as a whole. The research indicates, in general, that we can understand the mental capabilities and processes of a child only if we see them as a part of his entire development.

Briefly, research in the field of child development has given us rather detailed information concerning the intellectual, motor and social development of children. At six, a child's thoughts are almost purely personal or at best are child to one-other-person relationships. By twelve, he continues to have these individual thoughts plus an interest in and an understanding of happenings in the world at large. Some children arrive at the latter stage earlier than others. The point is this: Intellectual development must be considered as individual intellectual development, not as group intellectual development.

So far as motor development is concerned, children are active. They possess much energy. This is true of children at all age levels in the elementary school. In regard to social development, we know that at five and six children do mostly individual work. They frequently talk aloud, and the casual observer may think that

these young children are exchanging ideas. But, more often than not, it will be found that children are verbalizing merely for their own individual benefit. In addition, it is difficult for these young children to share experiences with tangible materials unless the group is quite small. On the other hand, the twelve-year-old retains the capacity for individual work, but is much better able to fill his role as a participating member of a fairly large group.

IMPLICATIONS OF RESEARCH WITH RESPECT TO SELECTION OF OBJECTIVES AND CONTENT

The fact that children react as individuals indicates that objectives for instruction in science in the elementary school must be in terms of large goals. Subject matter facts to be used might conceivably be entirely different for each child, although this is not usually the case. However, the understanding of each subject-matter learning is an individual matter, and the degree of progress toward an understanding of each large goal is certainly individual. We have been on the right track here in proposing such large goals for instruction as the following:

Improving in ability to attack a problem and come to a satisfactory conclusion in regard to the problem.

Becoming more and more responsible in making and carrying out plans.

Growing in ability to work with others on the problem in hand.

Becoming better able to observe and experiment carefully in working toward the solution of a problem.

Becoming better able to approach the solution of a problem with an open mind and yet be critical of personal ideas and of the ideas of others.

Gaining a progressively better understanding of such basic concepts as variety, change, adaptation, interrelationships, space, and time.

Gaining a feeling of security in, and an ability to more effectively make use of the environment.

Certain studies throw some light on the possibilities of achievement of these goals by young children. Haupt[1] showed that certain subject matter generalizations could be learned. West[2] developed a technique for isolating and analyzing overt responses related to problem solving, cooperation, responsibility and similar goals. Hill[3] showed that elementary school children at all age levels make about the same proportionate number of responses to the objectives previously mentioned.

It would seem, from this latter study, that the ability to respond in the light of these objectives is not necessarily brought about by science instruction but is a natural kind of response. The basis for this conclusion is the fact that six-year-old children who have had little instruction in science make about as many responses related to these goals as do eleven-year-old children who have had several years of such instruction. This same study, however, indicates that an analysis of the verbatim remarks of children does show that remarks of older children are, in general, more discriminatory than the remarks of younger children. For example, six-year-olds seem to question primarily for purposes of identification in making such inquiries as "What leaf is that?" and "What is mercury?". The inquiries of older children often reveal a struggle for proof in such a question as "How do you account for the light that comes from the sun (if it is not burning)?"

[1] Haupt, George W. *Experimental Application of a Philosophy of Science Teaching in an Elementary School.* New York: Bureau of Publications, Teachers College, Columbia University, 1935.

[2] West, Joe Young. *A Technique for Appraising Certain Observable Behavior of Children in Science in Elementary Schools.* New York: Bureau of Publications, Teachers College, Columbia University, 1937.

[3] Hill, Katherine E. *Children's Contributions in Science Discussions.* New York: Bureau of Publications, Teachers College, Columbia University, 1947.

However, it is also true that some younger children make responses which one might expect from older children and vice versa. In other words, progress is individual.

Research findings in the general field of child development seem to give further evidence that progress with regard to our objectives is not due solely to science instruction, but may well be a natural growth process. Baker [4] was interested in cooperative discussion of a topic, not necessarily a science topic. His findings showed that 87 per cent of all second grade contributions represented a new topic with no logical tie-up to a previously made remark; 33 per cent of all fourth grade contributions were of this type; while only 23 per cent of all sixth grade contributions were of this type. Progress in cooperative discussion, at any rate, seems to be a natural outcome, not necessarily limited to use in science discussions.

In investigating progress in ability to generalize, Jersild, Markey and Jersild [5] asked children to make three wishes. At the five and six-year-old level, 55 per cent of the wishes were for specific material objects; at the eleven and twelve-year-old level only 14 per cent of the wishes were of this type. The older children wished for a sum of money. When the children were questioned as to the use of the money, they indicated a number of objects they wished to buy. Children do learn to generalize.

Ames [6] was interested in gaining information concerning progress made by children in relation to the concept of time. In this study of children from the ages of one and one-half to five years of age, it was found that children become oriented to time in a relatively uniform sequence. The sequence is first the present, then the future, and then the past. Pistor [7] found that while only 1 per cent of children in the fourth, fifth and sixth grades indicated that "yesterday" was " a long time ago," 52 per cent of these same children indicated that "tomorrow" was "a long time to come." We see, then, that children vary in their understanding of the concept of time. But it is important to note that they do have some understanding of this concept at an early age.

It is difficult to study those goals for science instruction which are concerned with attitudes. The studies of West and Hill which were previously mentioned indicate, however, that young children are critical-minded, open-minded, cooperative and responsible.

Other studies have given us information relating to subject matter choices of children. Craig,[8] in analyzing some 7,000 children's questions, found them to be about equally distributed through all the various areas of the Natural Sciences. In addition, Williams [9] found children's choices in science books to be well distributed among various subjects. However, it was found that certain books dealing with active objects such as airplanes seemed preferred to those dealing with seemingly less active materials such as plants. Baker, in the study previously cited concerning children's undirected discussion, found that children

[4] Baker, Harold V. *Children's Contributions in Elementary School General Discussion.* New York: Bureau of Publications, Teachers College, Columbia University, 1942.

[5] Jersild, Arthur T., Markey, Frances V., and Jersild, Catherine L. *Children's Fears, Dreams, Wishes, Daydreams, Likes, Dislikes, Pleasant and Unpleasant Memories.* New York: Bureau of Publications, Teachers College, Columbia University, 1933.

[6] Ames, Louise B. "The Development of the Sense of Time in the Young Child." *Pedagogical Summary and Journal of Genetic Psychology,* March, 1946, 68:97–125.

[7] Pistor, F. "How Time Concepts Are Acquired by Children." *Educational Method,* 1940, 20:107–112.

[8] Craig, Gerald S. *Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann Elementary School.* New York: Bureau of Publications, Teachers College, Columbia University, 1927.

[9] Williams, Alice M. *Children's Choices in Science Books.* New York: Bureau of Publications, Teachers College, Columbia University, 1939.

talked of "active" topics such as pets, the sinking of a submarine, a trip to the zoo, or the making of a toy. It is, furthermore, the evidence of a good many classroom teachers that the best development toward desired goals occurs through active content and not through a program which is limited to a "telling" on the part of the teacher and a "reading about" on the part of the child.

SUGGESTIONS FOR FURTHER INVESTIGATION

The trend, then, in Elementary Science when it is considered in relation to child development, is to more thoroughly understand the child. We must learn to take him wherever he is and proceed from that point on an *individual* basis. We need to know much more about how children think, how their attitudes and concepts develop. We need, furthermore, to suggest curriculum materials in science based upon the facts of child development. It seems, therefore, appropriate to suggest the following research.

1. Assuming that we really do see Elementary Science as only one learning area contributing to the normal growth of a child, we need to determine how this area can contribute most effectively. We must continue to see science experiences as a part of a balanced program for children. This is borne out and some suggestions are made concerning curriculum development in the section devoted to Elementary Science in the 46th Yearbook of the National Society for the Study of Education.[10]

2. We know, from basic research that even the youngest children, the two, three and four-year-olds, are capable of dealing with the materials and ideas of science. Some specialists in the general area of child development are convinced that it is during these years that an individual develops his conscience and probably his life-long attitudes. If this is so, science experiences directed toward such large goals as interrelationships and open-mindedness are doubly important for children at the nursery and kindergarten level. Yet this is the most neglected area in regard to suggestions for curriculum development in the entire field of science for children. We need much work here.

3. Many classroom teachers accept and are working toward those large goals which we advocate for science instruction in the elementary school. However, they find it extremely difficult to evaluate the progress of individuals with respect to these large goals. If we are to help these teachers hold their ground in working toward large objectives in Elementary Science, not toward the memorization of subject matter facts, we must help them with the problem of evaluation in a very practical way.

[10] Noll, Victor H. (Chairman). The Forty-sixth Yearbook of the National Society for the Study of Education, Part I. *Science Education in American Schools.* Chicago: The University of Chicago Press, 1947.

PREPARING CRITIC TEACHERS TO SUPERVISE AND TEACH ELEMENTARY SCIENCE *

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THERE is no doubt that the effectiveness of the elementary science programs in the public schools depends partially upon the effectiveness of the teacher-training programs in the elementary grades of the practice schools of the various teachers colleges. It is consequently my purpose to present briefly the status of elementary science teaching as it now exists in some of these practice schools and to state various procedures being used to develop an effective elementary science program at the Iowa State Teachers College. Unfor-

* Presented at the National Council on Elementary Science meeting at Atlantic City, New Jersey, February 22, 1948.

tunately, a very pleasant picture cannot be painted; more accurately, it is best described as rather distressing.

During the last four months, I have had the opportunity to discuss the condition of elementary science teaching with the chairmen of science in the practice schools of five teachers colleges other than the one where I am now employed, and the situation in elementary science teaching is almost identical in all. I am therefore presenting the situation as it exists in these teachers colleges, distinctly not as unique, but typical in all of them.

From the practice schools of these various teachers colleges comes yearly between 35–50 per cent of the elementary school teachers who enter the teaching profession in their respective states. It can therefore be seen that these colleges have a great influence in molding the teaching in the elementary schools of these states. In most of these schools one-half of the elementary graduates receive the four-year bachelor's degree in education, the other half receive the two-year certificates which qualify them for employment in rural elementary schools. In all of these colleges, the requirements for science generally consist of a one-semester course in a survey of the physical sciences, and a one-semester course in a survey of the biological sciences. This represents about 9 per cent of the total academic hours required for the two-year certificate and about 5 per cent of those required for the four-year degree. In all of the schools students may elect additional science courses, but less than 4 per cent of the elementary student teachers do so. Methods of teaching are required usually in the following subjects: reading, spelling, English, social studies and music. In no case are methods for teaching elementary science required.

It is therefore obvious that these student teachers have a very sketchy background in science when they come to the practice schools for practice teaching and so it becomes the task of the critic teachers to provide additional assistance in organizing science units and lessons. But let us see how well prepared are these critic teachers to supervise student teachers in teaching science.

A survey was made of the academic backgrounds of the eighteen elementary critic teachers at one of these schools, chosen at random, to determine what courses in science they had taken. The results were not conducive to optimism:

1. Five of the eighteen critic teachers had never had a science course in their lives.
2. The best prepared teacher had taken 20 per cent of his total academic hours in science. The next best prepared had had 11 per cent of his academic hours in science.
3. The average of the whole faculty was 5 per cent science hours of their total academic hours.
4. There was no graduate work in science or science methods for any member of the elementary staff.
5. Only one elementary teacher, and this one an out-of-the-building teacher, had had elementary science methods.
6. The total academic science hours for the eighteen staff members was 169.5. Recent informal science interest surveys which we conducted among the pupils in elementary schools indicate that the predominant interest in the science area is in physical science, such as radio, the atom, jet-propulsion, and X-rays. The total physical science hours for this staff was 47. This was 28 per cent of the total academic science hours of the staff and three-fourths of these 47 physical science hours had been taken by only three persons.
7. The following are the academic science backgrounds of the three elementary teachers who are on the science committee in this school:
   a. No science for one member.
   b. A second member had 7.5 undergraduate hours. These hours were taken 16 years ago, 2.5 of these in physical science.
   c. The third member had 16 hours of botany which was taken 27 years ago.

Recognizing that these same data are applicable to any one of these schools investigated, it is justifiable to state that the present elementary science programs in them are in dire straits.

In summary, it may be stated that the following inadequacies exist on the part of the critic teachers in these various teachers colleges:

1. The lack of adequate subject-matter and methods backgrounds in science.

2. The lack of familiarity with equipment for demonstration purposes.
3. The belief that science experiences are best treated incidentally and only as contributory to the social studies program. In such cases the science program has largely become accidental or in most cases non-existent.

At Iowa State Teachers College, as in the case of these colleges, plans have been made for in-service training of these teachers. Since we are desirous of providing some type of science program for these pupils in the elementary school immediately, and also some science program with which the student teachers can work, it is obvious that two plans are necessary, first, a temporary expedient and, second, a long-term plan. There is no doubt but that the temporary expedient violates some of the better practices for elementary science teaching, but in order to provide immediate assistance to our student and critic teachers, we decided it would be worthwhile to undertake.

These steps are being taken:

1. In as many rooms as time permits, the chairman of science gives special lessons in science to the pupils in the Campus elementary school. These lessons occur more or less incidentally. One example of this type of lesson occurred recently. One of the children brought in a report of "getting shocked" when touching a door knob after walking across the rug in his home. He also noted "sparks" between his hand and the door knob when it was dark.

Another child added to the discussion, the story of seeing "sparks" when she rubbed her cat's back at night.

At the request of the elementary critic teacher, the chairman of science appeared in the class to explain these phenomena, and as a result of the discussion, a week's unit on static electricity emerged.

A similar instance occurred when a child, whose father had been a soldier in the South Pacific during World War II, submitted a piece of coral for examination. From this simple beginning a unit on sea animals was carried on.

2. At present those secondary student teachers who have acquitted themselves exceptionally well in secondary student teaching, and who express a desire to do so, may elect a second term of student teaching during which they will assist these elementary critic and student teachers in organizing subject-matter and in setting up demonstrations for broad science units. This program has been exceptionally successful. We are at present short of these student teachers to supply the requests for aid.

3. Whenever an elementary teacher decides to initiate some science unit, the science department suggests experiments and demonstrations and will present them if necessary.

4. The following books written by Lynde were made available to each critic teacher:
   a. "Science Experiences with Home Equipment."
   b. "Science Experiences with 10¢-Store Equipment."
   c. "Science Experiences with Inexpensive Equipment."

The long-range plan, however, is taking the greatest percentage of attention and is being attacked in these ways:

1. To all elementary teachers were made available Craig's "Science for the Elementary Teacher," the 31st and the 46th Yearbooks of the National Society for the Study of Education, and newly-developed syllabi for elementary science, based on the twelve-year program, such as the Ohio and Illinois syllabi. While the mere distribution of these materials in itself will not assure their being read, there is no doubt that many teachers have done so. In this way we have provided the more authoritative science materials for these teachers to examine.

2. Most important was the need for a change of philosophy. It was obvious that before any science program could be developed, the elementary critic teachers should remove science from the "accidental" list of subjects and place it on a par with other subjects in the curriculum. The

elementary science committee as such was therefore abolished and a science committee covering the twelve grades was organized. Objectives for science were set up which were terminal objectives for a twelve-year general education program. These objectives were established using the criterion: What understandings, knowledges, skills and attitudes with respect to science should all students have upon leaving high school.

No objectives for grades or courses were formulated. The content of courses *and* the science experiences in the grades are now being determined on the basis of the objectives of the twelve-year developmental program in science. In this way the elementary critic teachers are coming to see that the science they present contributes toward a total school objective and that such science lessons and experiences should be planned for that pattern.

It can be seen that we have accepted the developmental science program as presented in the 31st and the 46th Yearbooks of the NSSE. Despite certain loud criticisms against the philosophy presented by these yearbooks, we believe that the "Better 'ole" has not yet been offered.

3. Further, all elementary critic and student teachers are now invited to attend the science department seminars where the developing curriculum is being discussed. No part of the new curriculum is considered accepted, unless all elementary teachers have been informed of such developments and agree to them. This process necessarily slows the progress of the science committee, but the rapport established makes it worthwhile.

4. At the present time, some of our student teachers are working on a list of films which may be of value for elementary science. Under the supervision of the chairman, one of these student teachers developed a rating scale for elementary films, then made a list of every elementary science film now published. We are reviewing these films as quickly as possible, rating them on the basis of this rating scale and preparing lists of elementary films which seem to us to have value for our program. A manual will be prepared for use of the elementary critic teachers, discussing the proper use of films in elementary science, describing each film listed and, finally, stating the specific teaching area where the film may best be used.

5. We are at present preparing lists of experiments which can be performed by the elementary students. Although we recognize the value of demonstrations, there seems to be no reason why certain exercises for pupil experimentation cannot be used. We are hoping specifically to prepare lists of and procedures for pupil experiments which can be used in the elementary science classes. These are being selected for their contributions to the basic objectives of our science program, not merely for the purpose of manipulation or for object study.

It cannot be too strongly stressed that, above all, we are trying to instill in the minds of the teachers that one of the primary functions of the science program is training the children in the use of the inductive method. We want our children in all science courses to draw conclusions and make generalizations. If the course material is presented in such a manner, it becomes a personal experience for the child, rather than a mere reading or listening exercise. This will be a panacea for the present common evil of reading about science rather than doing science.

It must be stated that these procedures are now being undertaken, and in no sense have we completed our program. We are still far off from our objective of converting into practice the philosophy of the developmental program found in the yearbooks.

The brief statement which has been given to you may well be applied by any administrator desirous of building his elementary science program. Our situation is unique from the average elementary school situation only in the fact that our teachers have the additional responsibility of student teachers.

It is a long path ahead and there is still much to be done, but we hope that our efforts to improve our own teaching program will result in better science teaching in the elementary grades in Iowa, and ultimately, in the nation.

FIRST GRADE CONCEPTS OF THE MOON

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WE who teach young children know how the moon appeals to them. They like poems about the moon. They like to hear stories about the moon. They talk and sing about the moon. "The man in the moon" delights them. But, both as classroom teachers and as students of child psychology, we need to know more concerning how and where such appeal merges with understanding.

PURPOSE OF THE STUDY

This article reports some results of a study of Pre-Instructional and Instructional Concepts * of children in a first grade. All of the concepts deal with the moon. We note a gradation from concepts that result from direct observation through a range of reasonings. The study sought information on such gradation. We note, also, differences among those concepts that are the result of reasoning. The study sought information on these differences. This article, then, reports a selection of concepts that range from direct observation through various grades of explanation; it indicates some of the kinds of explanations; and it offers an interpretation of some of the findings.

SOURCE OF THE DATA

The data come from the Laboratory School of The New Jersey State Teachers College at Glassboro. The regular classroom teacher † taught the lessons. The teacher accepted and applied many of the author's suggestions. The author kept the notes of the children's comments. No other observers were present.

CATEGORIES OF THE CONCEPTS

In what terms did these children speak of the moon? What are the divisions of their ideas? Teachers find such classifications an aid in their work and students of child psychology use such classifications as verifications and indices in their research. The concepts of these children fall in five categories. The children speak of *Surface and Composition, Size, Motions, Moonlight,* and *Phases.*

DIVISIONS OF THE CATEGORIES

Under each category, the concepts are classified as "A" and "B." Classification "A" refers to concepts that depend on observation only. For example, "I see a face in the moon" or "The moon goes higher and higher in the evening" or "The moon is not always round." Classification "B" refers to concepts that go beyond observation. Here, the children explain; they evidence reasoning. For example, "Holes make the moon look as if it is a man" or "The moon goes round the earth once a month" or "Clouds cover the moon and make it different shapes." [1]

THE CONCEPTS

No change in the wording of the concepts has been made; the statements are as

* "Instructional Concepts" develop during teaching. The teacher does not present them. Some psychologists refer to them as "Cognitive Intercourse."

† Mrs. Margaret M. Rieck.

[1] For discussion of a basis for such classification see: Craig, G. S. Science In Childhood Education. Chapter I. Bureau of Publications, Teachers College, Columbia University, 1944.

made by the children. The classification is artificial in the sense that it emerged after the lessons. We did not know beforehand the categories under which the statements would fall. The only organization known to the children was that implied by the suggestion "let's talk about the moon."

Surface And Composition

A

I never saw a face on the moon
I see a face in the moon

B

There is no real face in the moon

There are big holes in the moon
Holes make the moon look as if it is a man

The moon is made of rocks and mountains
The moon is made of light weight stone

Clouds cover the moon and make it look like a face in the moon

---

The moon is filled with water
There is no water on the moon for the water would put the gases out

---

The moon has no gravity. This gravity holds you down. It is like magic. Things would float along without gravity. If I jumped, and the gravity went away, I would just float around. They shot a new kind of bomb in the air and they can't find the bomb yet.

Size

A

The moon is smaller than the earth

B

The moon is bigger than the earth

Motions

A

The moon moves
The moon goes higher and higher in the evening

B

The moon goes round the earth once a month [2]

Moonlight

A

None

B

The sun shines on the moon
We see the sun shining on the moon

[2] The child insisted upon placing a diagram on the blackboard of the moon revolving about the earth, explaining as she drew.

The sun reflects on the moon
The sun shines down on the little moon. Then this moon reflects the sunlight.

Phases

A

Sometimes I see two moons; a finger nail moon and a round moon
The moon is not always round. It is like a banana sometimes. Real skinny.
The moon looks like a finger nail. Sometimes the finger nail goes the other way.

B

Clouds cover the moon and make it different shapes.

I think that the sun reflects on that side of the moon. This makes it different shapes.
We see the sunlight shining on the moon. Then the moon shows us different shapes.

INTERPRETATION

The discussion that follows has been used in two types of classes: students in teachers colleges and teachers-in-service. The students in teachers colleges were juniors and they had studied science for two years—one year of Physical Science and one year of Biological Science. These juniors had observed lessons in elementary science and they had taught one or more such lessons. The teachers-in-service were graduates of teachers college and they had taught in elementary school for at least three years.

The features selected for discussion are those that help to explain present practices in the elementary school science classroom or they indicate fields for future research in the teaching of elementary science. In some cases both criteria are met. The reading references relate, predominantly, to the psychology of learning.

Surface and Composition

Undoubtedly, some of these concepts result from previous instruction. The children speak of rocks and mountains. They mention light weight stone. They hint at a cause and effect relationship between rocks, mountains, stones and the appearance of a face on the moon.

Of course, these particular statements are statements of fact; they do not show much reasoning. But several questions

arise. What reasoning, based upon these facts, could we have effected on this first grade level if we had utilized these facts in instruction? If Pre-First grade children were given significant experiences and concepts relative to their natural environment, what progress in interpretation, beyond our present standards, could we make in First Grade? What are some of the relationships between maturation and experience? In this connection, an observation by Isaacs [3] has relevance:

> "We have been content to apply our new psychological knowledge of *how* the child learns, to the ways of getting him to learn old things. We have not used it to enrich our understanding of *what* he needs to learn, nor of what experiences the school should bring to him."

Two statements indicate reasoning based on prior experience: "Holes make the moon look as if it is a man" and "Clouds cover the moon and make it look like a face in the moon." Probably, these ideas were not given to the children. They might have received the explanation in terms of holes, but not the one in terms of clouds. These statements represent typical "as if" concepts.[4] The children explain the face in the moon *as if* it were made by shadows from holes and from clouds. We expect children on this grade level to have had experiences with shadows formed from holes and from clouds. If they did have such prior experience, they would draw upon it here.

The statements relative to the gravitational effects of moon and earth are of considerable interest. Note: "They shot a new kind of bomb into the air and they can't find the bomb yet." [5] The child thinks of two series of phenomena in terms of a common basis. Further, the basis common to both is neither simple nor obvious. Here is reasoning of a relatively high order. Also, the thinking relates to a projectile (the moon) and, as has been indicated,[6] projectiles involve categories of thinking that are of fundamental importance in genetic psychology.

Size

We have but two statements from these children relative to dimensions of the moon. Both compare the moon with the earth. What do the children mean when they say, "The moon is smaller than the earth?" Do they mean that it looks smaller? Do they mean that it is smaller, actually? We do not know. Here, we could have used Piaget's question and answer technique [7] to advantage.

The statement, "The moon is smaller than the earth" is classified as an observational concept. We classify it thus because the moon does look smaller than a house, a town or a state. Discounting a guess in this case, we expect untaught children to say that the moon is smaller than the earth. This whole question of children's concepts of size (and space) needs investigation.[8]

Motions

The concepts that we have from these children relative to lunar motion are few but they are significant when compared with some of the findings and interpretations of Piaget.[9] Piaget says that "the explanation of movement is the central

[3] Isaacs, Susan. *Intellectual Growth in Young Children*. Pp. 21. Harcourt, Brace and Company, New York, 1930.

[4] Haupt, G. W. "A Neglected Factor in the Teaching of Elementary Science." SCIENCE EDUCATION (January, 1939), 23:31–34.

[5] For a discussion of the experiment to which the child refers see: "Going Up For Keeps." *Popular Science*, March, 1947, p. 66.

[6] Piaget, J. *The Child's Conception of Physical Causality*. Pp. 18–25. Harcourt, Brace and Company, New York, 1930.

[7] Piaget, J. *Op. cit.*

[8] Hurlock, E. B. *Child Development*. P. 293–295. McGraw-Hill Book Company, New York, 1942.

Johnson, B. J. *Child Psychology*. P. 254–266. Charles C. Thomas, 1932.

Kirkpatrick, E. A. *The Individual in the Making*. P. 160–161. Houghton Mifflin Company, Boston, 1911.

[9] Piaget, J. *Op. cit.* Chapter III.

point to which all the ideas (of children) about the world converge." He then states that children of ages 5–9½ years explain lunar motion in one or more of the following ways: spontaneity of motion, as subject to moral constraint, magic, animism, and mechanical (moon makes air that pushes it along). Our data show none of these ways of explanation. We recognize, of course, that Piaget questioned his children, that he used more children than we used in this study, and that his average mental levels were lower than ours. But we are seeking for other explanations of the differences between his data and ours. For one thing, we go further than Piaget in his belief that motion is the focus of children's ideas about the world. We suggest, on the basis of research, that *transformation* of motion (energy) is that focus.[10]

Note that these children say "The moon goes higher and higher in the evening." At no time do they intimate that they know that the moon goes higher and higher in the daytime. In other words, these First Grade children gave no evidence of any conception of the relationship of rotation of the earth and revolution of the moon.[11] Of course, we would not expect them to understand these relationships. But emergence of the awareness is of psychological significance.[12] It bears on the problem of complexity of synthesis at various grade levels. We have made some study of such syntheses and we have others under way. But we note how a basis for an understanding of the combined motions of the earth and the moon is present at this first grade level.

Moonlight

It is interesting that we find, under this category, only concepts that imply reasoning or previous instruction. We find no concepts that result, solely, from observation. Yet, for such a category as "Moonlight" we look for elementary concepts of the observational type. A possible explanation is the awareness, on the part of the children, of the presence of the teacher and observer. The children thought that an "explanation" type of answer was expected of them and they gave it. We did not get the observational fringes of their ideas. Could the complex, Teacher-Observer-Child have occasioned the type of response made by the children? If so, we have, here, an illustration of the dependence of child learning and response on "total environment." "Total environment" in elementary science needs investigation for it has an important bearing on our test results.[13]

Note the uses of the word "reflect." One child says, "the sun reflects on the moon." This is a lack of understanding of the process of reflection. This particular lack of understanding is fairly common on higher grade levels. Perhaps we can correct it on lower grade levels. However, one child states the relationships correctly: "the moon reflects the sunlight." In this connection, note the concept of direction in the statement "the sun shines down on the little moon."

Phases

Explanations of phases of the moon are closely related to the category (Moonlight) that we have just discussed. Indeed, an organization other than the one we used here might have related all of the categories which, in this discussion, are sep-

[10] Haupt, G. W. "An Experimental Application of a Philosophy of Science Teaching in an Elementary School." *Contributions to Education*, No. 633. 1935. Bureau of Publications, Teachers College, Columbia University, New York City.

[11] For a discussion, on adult level, of such relationships see: Haupt, G. W. "Essential Angles of the Celestial Sphere." *Monthly Evening Sky Map*, Vol. XXXIX, No. 441, p. 8–9. Also, Vol. XXXIX, No. 444, p. 8–9.

[12] Commins, W. D. *Principles of Educational Psychology*. P. 22–26. The Ronald Press Company, 1937.

[13] Jones, H. E., et al. "Environmental Handicap in Mental Test Performance. *University of California Publications in Psychology*, 1932. No. 3.

arated. And such an organization would be of great help in understanding the relative significance of various relations and sets of relations.[14]

The problem of the relative significance of various relations is complex but it may be resolved to working dimensions. What is the whole of which the smaller relations are parts? Which relations, among the many separate sets, are decisive in defining the large concept? How, where and when does insight come?

After all, it is for insight that we work. We who teach science to children know what that insight means to them and we know what our role in its attainment by them means to us. As moon is to sun, so is knowledge to insight.

[14] Hartmann, G. W. *Gestalt Psychology.* Chapter II. The Ronald Press, 1935.

A SEARCH FOR WORLD-FRIENDSHIP THROUGH SCIENCE

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THE idea for world-wide science did not start off the work for World-Friendship at Walt Whitman School. The original spark came from something elemental and powerful. It grew out of the children's realization that no microscope is good for the child that is dying from hunger and cold. It grew out of a deep compassion for keeping alive the innocent candidates for extinction; it grew as a matter of deep feeling among staff and children alike, a longing to take care of the awful hunger and suffering abroad.

The idea grew out of a search for a more permanent answer to these recurrent crises of our civilization. And thus it grew in part into an expression of World-Friendship on a more specialized level, and is becoming a search for World-Friendship through science.

This is in part the spirit behind the efforts at Walt Whitman School. Science should be furthered anywhere and everywhere in the world. We know that "to be or not to be" depends today largely on science. Because that is so, and because modern life needs the intelligent idealism science can create, Walt Whitman School sees its science-program as an international must as well as a universal hope.

But how is it done? How is this program worked out in practice? How is a multiplicity of detail geared to this singularity of purpose? How is it woven into the work of the Grades?

Let us take a look at the work of Grade Four. It began there with a letter which told about the lack of needles and sewing materials abroad. The story of a needle, gone rusty four times and four times de-rusted, captured their imagination. The children timed a sewing experiment with such a needle; they scraped the rust off and tried again. They did it just the way the friend in Europe had done with the one and only needle left to the family. How different from the speed a nickel-plated needle can make. The watch with the second-hand made *that* clear enough. So it was not very long before these busy little people started collecting for Europe such items as stray pins and needles and thread. They talked about their project in Assembly and enlisted the help of others. Were they, themselves, not having great experiences with such humble articles?

They observed surface-tension by floating a needle in a huge bowl of water. Soon all of them were trying the experiment at home and with success. And they suspended threads in solution of copper-sulfate and nickel-nitrate, to see well formed crystals separating out. But a friend abroad could not see such perfection coming into being, unless he *had* a thread and a few chemicals for the experiment.

And the idea came to write letters about their observations, class-letters they were, to which each child contributed a few sen-

tences. These letters mentioned "molecules and surface tension," words, one boy admitted he understood but "couldn't too well explain without help," yet delighted in using.

Our idea has been to let the children ponder the phenomenon of a floating needle, which is the same everywhere on the earth. For as they marvel at it in quiet receptiveness, they are gaining in the understanding of science. And if they describe their own experiences and their own wonder to a "friend abroad," they are gaining in a kind of internationalism through science and in the awareness of the universality of man.

Let them spell WORLD-FRIENDSHIP in glowing letters, one for each science-dollar they bring in after working for it. Such a spirit can mean science-equipment for Yu-Tsai-School in China today, and science-equipment for a school in Poland, or in France, or in Austria, tomorrow, perhaps? It can mean reciprocity of ideas, exchange of letters about this experiment or that and later more than letters, visits even, to some no-longer-distant corner of the earth. Who knows?

Let the children of the earth work and do for one another. If there are potential weather-prophets in your group and if there is a set of colorful weather-flags in use, speak of the school where such simple yet picturesque objects are lacking, or maybe, not even known. Invite a keen young observer to make a set of these flags and to send them abroad.

This idea worked at Walt Whitman, where a Fourth-Grader made a set for Yu-Tsai during her vacation. Such flags are in international use. What could be more fitting than using them as a gesture of international good-will or as an acknowledgment of the science-interest of a friend abroad?

Concretely, this kind of thinking has found expression through the WORLD FRIENDSHIP FUND, which is now in its third year. Recently an appropriation from the Fund was made for $2,000.00 to be used for science-equipment for Yu-Tsai School. On the day that the Chinese college student came to Walt Whitman to receive the appropriation, the Fourth-Graders, as well as the rest of the students, understood that they had played an important role in making this donation possible. They had felt it by working for it.

Some of the pupils in the Junior High questioned the wisdom of making the appropriation at this time. And we adults could easily enough sympathize with their strong stand. Their objection was in the last analysis based upon an ethical conflict, a conflict which seems to defy solution. Our objectors felt that the World-Friendship-Fund should be entirely used for the emergency. And that emergency, they said, spells HUNGER! Millions dying from hunger and cold, leave us no other alternative. Such a grim spectacle is a strong reminder that it is time to forget everything else, as a matter of human concern as well as self-interest.

Who knows the answer? The right or the wrong of the choice? Some found the following line of reasoning partly convincing: That we must concentrate our help, rather than scatter it. That we must feed the gifted and lift up the intellects of promise, not with bread alone, but also with the tools of science and with its inspiration. And that we must, because of our limited means, select. Then we can help the few chosen ones in more ways than one. Many students understood this thought well. They understood too, that our time needs scientist-philosophers, who can tackle the job of making famines impossible in the future. They saw their gift in this light: that someone in the small school helped by us today, someone who is today receiving our bread and our gifts of science-tools might possibly turn out to be that potential scientist-humanitarian the world is looking for so anxiously!

The question: "Shouldn't we build up our own lab first?" asked by one of our realists the other day, was answered very satisfactorily with the purchase of two identical pieces of equipment, one for each

school. These were Tri-Purpose-Projectors. At the time the Fund appropriated $2,000.00 worth of general science-equipment, it shipped one of them to Yu-Tsai. "As they grow, we grow," was the answer, and the proof was right on hand, too.

For, as the students here will some day be making slides and film strips of their school activities, and of their experiences in art, and in music and in science, just so will our friends in Yu-Tsai make slides and film-strips of their life in school for exchange with us. A parallel growth for the evolution of a vital and substantial reciprocity; for a richer and more comprehensive exchange of ideas than mere letters permit.

They are inspiring ideas and they have inspired us. Yet the heart aches under the impotence of making its sympathy more widely felt. We must and we want to remember the awful hunger abroad. True, the "Fund" has achieved a great deal. Approximately $6,000.00 was collected in cash and probably that much again in values consisting of many tons of food, medicine and school-supplies. Considering the enormous needs, all this is only a "drop in the bucket." What is needed is a downpour of action along the lines traced! If World-Friendship through science is to become a world-wide reality, this sort of thinking must become the concern of Science-Education on even a broader basis than it now has. It must become the concern of Colleges as well as Elementary Schools.

In the Grades it is, of course, not strictly a matter of departmental effort, but rather of a concerted attempt for best results. When Grade Six, for example, concluded a showing of its tableaux on Egypt with the question: "And what are you, of today, contributing to civilization that is a lasting gift?" one answer might very well have been: We are trying for World-Friendship through World-Science!

Grade Six has concentrated lately upon plants, trees and products from trees. The children have worked with soils in the Botanical Garden Greenhouse, and have generally concerned themselves with conservation. While studying the manufacture of paper and pulp, they have seen experiments pertaining to this industry. They have seen a pink carnation "dyed white" and turn pink again, a process which has its parallel in the bleaching and the subsequent yellowing of paper with age. They have seen wood cooked in lye, and they have realized that unless done in a steam pressure cooker, the tough fibers will not soften sufficiently to be of much use.

These children feel they really know something about the paper-industry after seeing a good film and many slides covering its history, its science and its technology. The important thing however, is not only their increase in knowledge. The important thing is whether they are impressed enough with the manifold human efforts, the ancient skills and sciences entering into this vast industry to have developed a respect for it. Do they want to conserve and use wisely? Do they really want to save and share, so that others may benefit? Are they interested in the question of good use to the extent that children everywhere in the world may have the benefit of our abundance?

Of course, these traits are a matter of long-time growth. One must not expect too much of one experience. It is hard for children to cultivate the attitude of conservation, despite a certain intellectual grasp of its necessity. It is a case of the gap between idealism and long-standing habits of wastefulness. But receiving letters from those to whom paper and other school supplies have been sent, does make it somewhat easier: . . . "It is not beautiful," wrote one student, "when you have only scraps to write on, or the margins of newspapers." And another: . . . "Thanks for the notebooks and the pen; I hope they'll last till twenty-ten!" . . . Their response to this is enthusiastic as shown in substantial contributions of school-supplies for abroad. The good will is definitely there.

It must only now be kept alive, and this is done by the untiring efforts of their class-room teachers. With all adults stressing these ends, the work in Science can contribute a much more acute sensibility than it has up until now; a much greater awareness so that there may be clean, white sheets of paper for more and more children everywhere in the world, on which they may record their experiences for one another!

Yes, all this is very important, and yet today one cannot get away from the thought of hunger. The Fives have a crocodile who gets his red meat twice a week, but they know that most children in the war-torn countries have gone without red meat or its protein-equivalent for months and even years! The Fives keep fish, salamanders and white mice. They even have a moth-hatchery. What have the Fives abroad? Have they little pets they can feed and observe? Have they tanks, aquaria and jars of all sorts to keep them in? Can they study about glass like the Fives of Walt Whitman? Have they ever seen a cylinder, a thistle-tube or a thermometer? And have these children the strength to study anything at all and then experience the thrill which comes with writing up and acting out what one has learned?

Thoughts of this sort were kept alive as the Fives worked in the lab, on the topic of glass. In the end they wanted to give concrete proof that their hearts were beating in the right spot! They wished the crocodile in his elegant aquarium could feel that way about it too! So they gave a play about the art of glass-making, called: "The Princess with the Glass-Heart." They charged everybody a box of raisins to see the play, netting 205 of them, and an additional 23 cans of meat for World-Friendship.

Now they are writing about it all to their "friends abroad"—how they visited the old glassblower and tried their hand at bending glass; how they admired his immaculate laboratory; how they longed to be able to imitate the skillful master who could fashion glass into hearts as well as condensers. And they are writing about the older boy who made letters out of glass-rods, for a striking sign for their play. Elements are mentioned and recipes are given for crown-, flint- and plate-glass, and it seems that through these letters their science will reach out into the reality and actuality of living, in the same manner in which, through the play, it has reached into that realm, where fact and fancy mingle delightfully, and where at the same time truth is subtly revealed.

But there is nothing subtle about the grim, stark truth of death taking its toll among the children of the world. Our young physiologists and "erosion experts," the Sixes, Sevens and Eights are acutely aware of it. It is an uncomfortable feeling to be unwittingly and indirectly master over someone's life or death, because one either can, or cannot feed that additional person. So they urge the giving of more food again. Food for the fuel within, and quantities of it, if indeed neither coal nor shelter are available. Proteins, starches, sugars and above all, fats are lacking! And that is not mentioning the minerals and vitamins. The students hear of T.B. being on the increase, of boils and hunger-edema, of rickets and vitamin-deficiencies. One does not know where to begin first!

One day they heard the story of a clever old cook who works in a diner on a Long Island highway. What that intelligent cook does *not* do is pour bacon-drippings into the sink. He buys empty tin cans, fills them with the drippings and returns them to be sealed. It is all a matter of ten cents per can. Seldom does he hear of the fat arriving in rancid condition, and he has sent scores of cans. And even if the fat should become rancid, it could still be used in making soap. In some European countries a laborer has to work for two months to pay for the caloric wealth of such a can, were it at all available.

With the background of this story the Walt Whitman Fat-Station was opened.

For a while some children ate bacon for breakfast every morning. "I want to bring in those calories as soon as possible," you heard them say. To them the calorie is not a dead concept, not just a mere unit of heat, 540 of which change a gram of water into steam at 100 degrees centigrade. It is something that is needed for subsistence, and they want their friends abroad to have something beyond subsistence. They want to send extra calories for that warm glow of beauty and health, which you see in so many American children. They have learned that those low-calorie and starvation diets make people hate and want to kill. Such diets mustn't be allowed to continue anywhere in the world, but least of all under the flags of democracy.

And as the Christmas-shipping leaves for Europe, "Aid to France" wires its thanks for fats and foods received. Fifty pounds are off for another school! At that time Charles sits down to make a Peep-Show of his Fat-Station. It is a miniature display, a scene of snow and frozen splendor, in a box about twice the size of a shoe-box and illumined from above through colored tissue-paper. In the back is "happy New America"; to the left, under a starry sky you see "desolated Europe," with a school in which the windows are replaced by half-torn newspapers. A sleigh made out of a match-box is laden with tiny imitations of tin-colored fat-cans. The sleigh is on the way over, for the "snow-man," representing Charles, has just sped the dispatch along.

"Remember that for every ounce of food which is sent abroad you must give something back to our own soil." The president of The Garden Clubs of America makes this statement to the children in person. Quite a few have grasped the idea of soil-conservation already, for they have worked with soils during the entire fall. With the completion of the work, three more peep-shows have come into existence. Next to the "Happy Valley of Conservation" stands the "Grim Gulley of Desolation" and about the latter Anthony claims that the real thing, erosion in Lebanon, looks exactly like his peep-show! If you take the trouble of peeping, you can learn a good deal too about the Greenhouse, from Grade Six. Even the tools for potting the ivy and the tiny narcissus are there and so are the sacks of humus, sand and soil; the fertilizers, and behold! the sun itself, ready to shine at the turn of a switch. Everything is there in the Tom Thumb edition. "It is best to begin one's studies of conservation with plant-science," The Sixes seem to say.

During the Christmas Festival signs go up: "Conservation is a World-Wide Science" and "Come, see the Peep-Shows for World-Friendship." During the "Shows" the children go busily about enlightening youths and adults alike. They charge a nickel a peep, and they watch every newcomer for his admission fee. In the end the World-Friendship Fund is richer by over 50 dollars. The children are pleased with the proceeds, the shows being, after all, only displays in miniature. But plans are made at once for their next project, which they hope, will yield something in the three, or perhaps, even the four figures. And by way of contrast they decide to make it a "colossal" sort of enterprise.

This combined math- and social-science project was their one day "White-Elephant Sale." They made over five hundred dollars, and used this money to ship immediately fifty Care-Packages to their two adopted European schools. "We hope this will be good news to you . . ." they began their letter announcing the shipment. They decided to leave out the statement: "Toys sold like hot-cakes."

The Eights thought that two characters should have a prominent place in their Christmas program; a scientist and a philosopher. The dialogue between the two ran something like this:

"We've crossed the threshold to the nucleonic age," says the philosopher to the scientist. "Come away with me, away

from the Ivory Tower." And as the two step under the Tree of Humanity, the philosopher continues: "Don't you know me? I am really yourself; your other self or alter ego." After a while the scientist recognizes his double and looking about him, he suddenly notices thousands and thousands of children raising their sad and hungry eyes to him in hope and supplication. "Do something about it," whispers the philosopher, "do something soon! The time is almost up!"

The idea, that science among other media, can play a part in the search for World-Friendship among children has taken a hold at Walt Whitman School. It is clear to us that modern man can no longer indulge in hate, greed and injustice for the simple reason that such attitudes are unscientific. And so is our very selfishness.

For World-Friendship we need world-embracing science, fused with human compassion.

THE SETTING OF SCIENCE IN THE ELEMENTARY PROGRAM *

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INTRODUCTION

In recent years in America the science program has been given a more fundamental place in the elementary school curriculum. One reason for this is the development of an enlarged concept of the purposes and nature of elementary education. During this period there has been a growth in our understanding and recognition of the characteristics and needs of children.

There also has developed a broader view of the needs and conditions of our society, of the type of individual needed in a democracy, and of the role of the elementary school in contributing to social understanding and desirable social behavior. As a clearer view of the purposes of elementary education has been gained, there has arisen a greater awareness of the contribution the science program can make to their attainment. For example, the science program has much to offer in the attainment of such objectives of elementary education as helping children correctly understand and interpret the world in which they live, helping them meet intelligently their problems of living, and helping them develop desirable social behavior and attitudes. So do other phases of the school program as the social studies, the arts, mathematics, and the like.

The objectives of the elementary school science program, therefore, are the objectives of elementary education, and the content and the procedure in the science program stem from both society's needs and the nature and needs of children.

TRENDS IN CURRICULAR DEVELOPMENT

What are the trends in curricular development growing out of this better understanding of the growth and development of children and of the importance of science in their social education?

A. Meaningful and Socially Significant Problems.

That children learn best when they deal with problems which are vital to them is a widely accepted theory among educational authorities. Yet there has been, and still is,

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a great deal of teaching of the type where children memorize facts which have little meaning to them and little relation to their own lives. There are good elementary schools today, however, where the content of the science program is being organized around problems which have social value and which are significant in the lives of the children. These problems arise from the children's interest in interpreting their environment and from their need to solve intelligently their problems of living in such areas as health, safety, home making, conservation, and the like. The children themselves have a major part in setting up these problems. Here are some problems first grade children set up because of their interest in interpreting their environment:

1. What makes the rain come down?
2. Where does the rain come from?
3. How does the sun help the rain to come?
4. Does the wind help?
5. What makes the snow?
6. How does the snow help?
7. How do the plants get water?
8. Where does the water we put on the plants go?
9. What makes wet clothes get dry?
10. Where does the water go in our cleaning rags when we hang them up to dry?

All of these problems were not set up at the beginning of the study. Several arose as the work progressed, and as the children sought answers which would help them interpret their environment.

Children also meet problems of living in their classrooms. As a fourth grade class at the beginning of the school term planned how to make their classroom livable and attractive, these questions were set up:

1. What kinds of plants will be best for our room? How many do we need?
2. What shall we put in the window box?
3. How many new flower pots do we need?
4. What kind of soil is needed?
5. Where can we get the soil?
6. Where can we get the additional plants we shall need?
7. What color should we paint the window box and the old flower pots?
8. How can we arrange the plants to look pretty? What is meant by a balanced arrangement?
9. How should we care for our plants?
10. Which plants need more water than others? Why?
11. Which plants need more sun than others? Why?
12. What does the sun do for plants?

As the fourth grade solved these problems they used content from science, art, and consumer mathematics.

Both types of problems—those which are chiefly for the purpose of interpreting the environment and those which enable children to solve some immediate problem of living—are important and are interrelated in the work of the children.

The way of solving problems is also exceedingly important in helping boys and girls develop social understanding and put into practice desirable social behavior. In the first grade class whose questions were read, the teacher asked: "How can we find the answers to the questions?" Among the children's suggestions were these: "We can read in science books" (and some of the children could read well enough to do this); "You can read to us"; "We can make experiments"; "We can ask someone who knows." As a part of following through on these suggestions, the teacher asked: "How can we find what experiments to make?" A child mentioned that the science books gave some, and the teacher chose a group of volunteers to look in the science books for suitable experiments, indicating that she would be glad to meet with the group if it needed help. And so the work proceeded with the teacher putting emphasis on helping the children think through and find out for themselves, and helping them to use scientific methods of finding out. At the same time a variety of procedures of finding out were utilized, such as reading to the children, discussing, observing, making experiments, and having a science teacher participate in a discussion.

Thus, as these illustrations bring out, the problems that children solve should have social value and should be significant to them. Likewise, a variety of procedures should be used in solving problems, and scientific methods of work should be utilized by the children. In these ways are

the best guarantee that children will develop meanings and attitudes necessary for social understanding and desirable social behavior.

B. A second trend in curricular development is a flexible curriculum suited to the needs of the children and the community.

In order for problems to be meaningful and socially significant to children, they should be selected in terms of the interests, background, and needs of the particular group. A rigidly planned science program which sets up the specific content and achievement goals does not provide adequately for the varying needs of children in different communities. Neither does it meet the needs of individual children within a class. A number of school systems, therefore, are giving individual schools and teachers opportunity within a broad framework to develop science programs suited to the needs of their particular children and communities. This does not mean that the programs are built around the whims of the children or the special interests of the teacher. Rather such teachers must make intensive studies of their children and their communities. They must set up classroom environments which will stimulate and develop interests on the part of the boys and girls, and must utilize the various environmental resources. They must look at the background and needs of the children in relation to well-rounded living and well-rounded growth, and think through long-time plans in terms of these. They must guide children's planing in such a way that there is growth in ability to make intelligent choices. With such planning on the part of the teacher a flexible curriculum provides opportunity to guide the children in a science program suited to their needs and to the needs of the community.

C. An integral relation to other phases of the program.

A third trend in curricular development is an integral relation to other phases of the school program. As pointed out above, "instruction in science contributes in a large measure to the attainment of the basic purposes of the elementary school. Since other phases of the school program contribute also to the attainment of the same purposes, a functional relationship between the phases often exists. This occurs when the satisfactory solution of problems calls for content from different fields, as social studies, science, health, and mathematics." For example, the third grade children previously mentioned had to use content from science, social studies, mathematics, and art to solve their problems regarding plants in the classroom. Likewise, they made use of oral and written language, reading, and spelling as they discussed, made plans, made records of the plans, wrote letters, and read to secure information. Thus the solution of problems which are significant to children frequently draw content from many phases of the curriculum and, therefore, are integrally related in the program.

In a number of schools and school systems programs called by such terms as 'basic education,' 'basic social program,' and 'core program' are being developed. These programs are designed to provide a more adequate social education for children. They deal with personal and social problems of living which are significant in the lives of the children and draw content from any field, such as science, social studies, health, the arts, and the language arts, as needed. A large block of time each day usually is devoted to activities which arise out of the solution of the problems.

Whatever the plan of program organization used in the elementary school, the science in the curriculum should have a close relationship to the other phases of the school program. Whether the program is organized in terms of subjects, or in terms of an integrated curriculum, it is important in solving problems to use content from any field which is needed, or to contribute content to problems in other fields.

Continuity in the Program

How can continuity in the science program be secured? How, particularly, can

it be secured in a science program which is flexible in providing for local needs, which is closely related to other phases of the school program, and which is organized in terms of socially significant problems?

Instruction in science during the year should provide a continuity of experience which will help children grow continuously (1) in the extention of their environment, (2) in the development of wider and deeper meanings, and (3) in the ability to do broader and more critical planning in solving their problems of living. Continuity of experience implies that the science program should be developed in terms of the meanings and understandings which the children have and that it should lead on to the building of larger and fuller meanings. Several factors influence the development of meanings.

Among these are, first, the suitability and significance of the problems to the children. As pointed out above, science problems should have social value. They also should be suited to the maturity level and background of the children, and they should be significant and meaningful to them.

A second factor which influences the development of meanings is the richness of the experiences which are brought into the solution of the problems. Children need to secure data from a variety of sources, and they need functional, first hand experiences in order to generalize, see relationships, and enlarge their concepts. Otherwise they learn to verbalize but do not relate and organize their experience.

A third factor which helps in the development of meanings is for the children themselves to have a part in setting up their problems, in planning what to do and how to do it, and evaluating what they did. Thus they learn to do broader and more critical planning. It is important to recognize, also, that all children in a class do not get the same meanings, or the same breadth and depth of meanings from similar experiences, and therefore, individual and group differences should be recognized and provided for.

The difficult job of the teacher, therefore, is so to guide children in the selection and solution of problems that continuity of learning results for all the children in the class. To accomplish this most effectively, the teacher will need to work along these lines:

(1) Know children—their growth sequences, their characteristics and differences at the age-level, and how they learn; know the background, interests and needs of the particular group of children, both as individuals and as a group.
(2) Plan ahead so that she has clearly in mind the needs of children in relation to the needs of society, the directions in which she expects growth to take place, and the varied types of problems and experiences which may be utilized to bring this growth.
(3) Work with the children in the intelligent selection of problems, plan with them ways of solving the problems, and guide them in using democratic and scientific methods of work.
(4) Guide the solution of the problems in such a way that a variety and balance of learning materials and activities are utilized, such as a variety of books, films, trips, experiments, and the like, and that individual and group differences are provided for.

The teacher who works along these lines will utilize the child's past experiences and the resources and problems of the environment in such a way that a readiness for new problems and new meanings are developed.

BALANCE IN THE PROGRAM

The question of continuity in the program leads definitely to the problem of how to secure balance in the science program. Criticism frequently has been made of both the social studies and science programs that they are not well-balanced—that they are too incidental, that they deal too much with the far away or else too much with the immediate, that they do not help children meet adequately their problems of living, and that they do not develop adequate meanings and understandings. All of us would agree that the science program should give children well-rounded experiences. However, a number of factors need to be taken into account in order to provide a well balanced content in science, and sev-

eral types of balances must be considered.

A. Balance in terms of areas of environment.

One of these is what is known as balance in terms of areas of the environment. Children should grow in an understanding of all aspects of their environment. Dr. Gerald S. Craig has listed these areas of the environment as "Beyond the Earth," "The Earth," "Conditions Necessary to Life," "Physical and Chemical Forces," and "Man's attempt to control the Environment."[1] It is helpful to use areas such as these as a check list in looking at balance—as one means of seeing what constitutes a well rounded scope. Such areas, however, suggest only one type of balance.

B. Balance in terms of areas of living.

A well rounded science program also will provide opportunities for children to understand and meet more intelligently their problems in the various areas of living. Boys and girls need help with problems of living in such areas as health and safety, conservation, homemaking, and the like. Such problems should be both personal and social in nature. The field of science has valuable content to contribute to the understanding and solution of problems in these phases. The areas of living, therefore, should also be used as one means of looking at balance.

C. Balance in Terms of Time and Space.

A third factor which is important to consider in a well-rounded science program is the proper balance between the 'near' and 'far' on the one hand and the 'long ago' and 'now' on the other. Children in every grade of the elementary school need experiences which help them deepen their understanding of their immediate environment. At the same time they should have experiences, in harmony with their maturity level, which will extend their environment in both time and space. Children's concepts of "near" and "far" and "now" and "long ago" change as they grow in years and experience. The primary grade child's interest in the "far" and "long ago" may be more incidental and transient than that of the upper grade child's; yet at every grade level there is a shuttle-like interest in both the "near" and the "far" and also the "long ago" and "now." Each deepens and reinforces the meaning of the other. Perhaps this interest most often begins with the "here" and "now" and leads out in a comparative way to the "far" or to the "long ago." For example, first and second grade children ask such questions as:

1. What were the first trains like?
2. What were the first airplanes like?
3. How long does it take an airplane to fly across the ocean?
4. How far away is the sun?
5. How long will it take our Junior Red Cross box to get to the European boys and girls?

Children differ a great deal in the age at which they grasp certain time and space concepts. First hand experience on the part of the child also plays a large part in the development of such concepts. An important thing to consider in looking at balance is that at every grade level, children need experiences which help them (1) deepen their understanding of their immediate environment, and (2) extend their environment in both time and space.

D. Number and Length of Problems.

Not only does the nature of the content influence balance in the science program but so also does the number and length of the problems studied. Children need a proper balance between short and long problems and usually both types may go on at the same time. Many problems which arise out of the daily living experiences of the children may be solved satisfactorily within a short span of time. On the other hand boys and girls need to solve problems which call for more extended planning and working on their part. The scope of long problems should be suited to the maturity level of the children and to their needs and interests at the time. Such

[1] Craig, Gerald S. *Science for the Elementary Teacher.* Ginn and Company, Boston, Massachusetts.

considerations will prevent the dragging out of the longer problems, and thus will give time for children to explore more aspects of their environment during the year.

E. Balance Throughout Elementary School Period.

Balance in the science curriculum should be considered in relation to the entire elementary school period as well as in terms of the yearly program. In order to secure a well-rounded program throughout the child's elementary school experience there should be cooperative planning on the part of the school staff. Such planning should result in the development of a flexible science curriculum. This should help teachers have clearly in mind the common purposes toward which they are working. It should suggest also a broad framework within which teachers may develop a program suited to the needs of their children and the community. Such a framework should be revised continuously in the light of the teachers' experiences as they build the curriculum with the children and evaluate their growth.

Another essential in the development of a well-rounded science program throughout the elementary school period is adequate cumulative records of children's group and individual experiences in science. Such records are necessary in order that teachers may know the previous experiences of the children and may work together in securing balance and continuity of learning. To secure a well-rounded science program, therefore, several types of balances need to be taken into account, and several factors need to be considered. No one scheme insures a well-balanced content.

SUMMARY

A better understanding of the nature and needs of the children and of the role of science in their social education have brought certain curricular trends in elementary school sciences. Among these are (1) organization of the science program around socially valuable problems which are significant in the lives of the children; (2) a flexible curriculum suited to the needs of the children and the community; (3) the development of an integral relationship to the other phases of the school program. The questions of how to provide a well-balanced science program and how to secure continuity of experience are vital ones in the development of an effective science program. They are questions which need much more study, thinking, and experimentation on the part of those who are interested in the education of elementary school children.

USING VISUAL-SENSORY AIDS IN TEACHING SCIENCE IN THE PRIMARY GRADES

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I. OVERVIEW

THIS paper describes primary grade children's experiences in simple science activities. It was not a planned unit of work. It developed and enlarged as the children asked questions and problems arose to be solved.

II. DESCRIPTION OF THE GROUP

The children in the group were in the last half of the first grade or first half of the second grade. They were a usual group of six and seven year old children. Some of them were shy and timid; afraid to ask a question or express an opinion. A few were overly aggressive. Some chattered incessantly. One or two were ready to fight at the drop of a hat and were very uncooperative and inattentive; but the majority were well adjusted socially.

III. How the Activity Began

I had a conversation period each morning that the group as a whole might become better adjusted socially. As the children became acquainted with me, the shy ones became more talkative and the chatterboxes learned to take their turn. One morning little Richard, a very shy child, was eager to talk. He had something interesting to tell us. He and his chum were digging a hole in his garden. They were planning to make a tunnel under the garden. Jimmy who had never contributed to the conversation before spoke up and said, "I think that would be dangerous. The tunnel might cave in and Richard would be smothered."

Of course I rose to the occasion and started asking questions. Jimmy explained that if Richard's face was covered with dirt he couldn't get any air. If he couldn't get any air he would die. My next question was, "Do we need air to live?"

The children were divided in their opinion so we pressed our handkerchiefs to our noses and mouths to find the answer. We found out how uncomfortable we became when our supply of air was shut off. The little conversation was the spring board to a science activity.

IV. Reasons for Giving the Children Science Experiences

I know children are naturally curious about everything in their environment. It is only when they are suppressed that they cease to ask questions. But if their curiosity is satisfied, if their desire to know more of the world about them is sympathetically guided, if they are given an opportunity to explore and experiment then the world will offer them an endless variety of interests and joy their whole life.

My desire was to give these children a greater feeling of security, to have them become better adjusted socially, to develop in them an inquiring mind, to teach them to work together in a group, to help them to improve their coordination and muscular control, and to develop in them the habit of careful and accurate work. I realized that through simple scientific studies my goal could best be reached.

V. How the Activity Developed and Moved Along

While discussion plays a vital part in studying science by encouraging growth in thinking, experimentation aids the child to visualize more clearly certain natural forces in action. Charles N. Eliot has said, "The best part of all human knowledge has come by exact and studied observation made through the senses of sight, hearing, taste, smell and touch. The most important part of education has always been the training of the senses through which that best part of knowledge comes. This training has two precious results in the individual, besides the faculty of accurate observation—one the acquisition of some sort of skill, the other the habits of careful reflection and measured reasoning which results in precise statement and record."

Having begun our study of science with a discussion about air, we decided to continue to find out all we could about air. With much guiding from me, we composed several questions about air and proceeded to find the answers through experimentation.

Shortly after our experimentation began, I realized the need of arranging the class room so experiments could be performed more easily. I arranged a science laboratory in one corner of the room. The laboratory consisted of four tables and a small book shelf. Above the tables was a sign "Science Corner." The tables were covered with oilcloth. The book shelf held the materials to be used when doing experiments. There were quart, pint, and half-pint bottles, funnels, pans, and measuring cups. As the activity progressed our list of equipment grew.

VI. A Description of Our Science Experiments

As we performed experiments to answer our questions I made a formula-type chart.

On the chart I put the question, the experiment we did, and the fact we learned. These charts were hung in the science corner. Later as the charts became more numerous they were put on a chart frame and made into more of a book. If the experiment was the kind a child could do by himself, he was free to go to the corner and try it any time he was at leisure.

The experiments we did about air follow—written as they were for the children on the charts in a simple formula-type story.

CAN ANYTHING LIVE WITHOUT AIR?

EXPERIMENT 1

What we did

We pressed our handkerchiefs over our noses and mouths.

What happened

We could not breathe comfortably when our noses and mouths were covered.

What we found out

We cannot live without air.

We must be careful not to get in a place where we cannot get any air.

EXPERIMENT 2

What we did

We put a grasshopper in an airtight jar. We put food and water in the jar.

What happened

The grasshopper died in a short time.

What we found out

Animals cannot live without air.

Food and water are not enough to keep animals alive.

EXPERIMENT 3

What we did

We put some water in a glass. We let the glass stand for a while.

What happened

We saw tiny bubbles in the glass. The bubbles were air.

What we found out

There is air in water.

Fish cannot live without air.

EXPERIMENT 4

What we did

We put vaseline on the leaves of a plant.

What happened

The leaves turned yellow and dropped off. The plant died.

What we found out

Plants cannot live without air.

EXPERIMENT 5

What we did

We dropped a lump of soil in a glass of water.

What happened

Bubbles came out of the soil and rose to the top of the water.

What we found out

There is air in the soil.

Worms and other animals that live underground cannot live without air.

DOES AIR TAKE UP SPACE?

EXPERIMENT 1

What we did

We blew into a paper bag. We blew on a balloon.

What happened

The bag swelled out. The balloon got big and round.

What we found out

Air filled the bag and balloon.

Air takes up space.

EXPERIMENT 2

What we did

We filled a pan with water.

We floated a cork on the water.

We turned a glass upside down over the cork.

We slowly tipped the glass to one side.

What happened

The water did not go into the glass.

The cork was on the bottom of the pan.

Something kept the water out of the glass.

When we tipped the glass bubbles came out of the glass and up through the water.

What we learned

The bubbles we saw were air.

Air had to go out of the glass before water could go in.

Air takes up space.

EXPERIMENT 3

What we did

We put a glass tube through a cork.

We put the cork in a bottle.

We poured water in the tube.

What happened

Not much of the water went in the bottle. Most of it spilled on the outside.

What we found out

If we want to fill a small mouthed bottle we must pour the liquid in a small stream; so air can go out as water goes in. Air was in the tube keeping the water out.

CAN AIR PUSH? DOES AIR HAVE PRESSURE?

Experiment 1

What we did

We filled a glass with water. We put a piece of paper over the glass. We held it in place with our hand. We turned the glass upside down. We took our hand away.

What happened

The paper did not come off. The water remained in the glass.

What we found out

Air pushed on the piece of paper. It kept the water in the glass.

Experiment 2

What we did

We filled a bottle with water. We put the top on. We made a hole in the bottle big enough to put a straw through. We melted candle wax around the hole to make the hole air tight. We sucked on the straw.

What happened

We could not get any water through the straw.

What we found out

Air must push on the top of the liquid to push the liquid up through the straw.

When we took the top off we could suck water through the straw. We sucked all the air out of the straw. The air pushed down on the top of the water. The water went up into the straw.

Experiment 3

What we did

We put a hole in a can. We filled the can with water. We kept our fingers over the hole. We put the cover on tight. We took our fingers away from the hole.

What happened

No water came out of the hole.

We took the top off. Water came out of the hole.

What we learned

Air pressed on the hole when the top was on the can and kept the water in.

What we found out

When we open a can of fruit juice we must put two holes in the can or it will not pour.

Experiment 4

What we did

We took two sheets of paper. We made one sheet into a ball. We left the other sheet flat. We dropped them at the same time.

What happened

The ball of paper fell faster.

What we learned

Air held the sheet of paper up longer. There was more air under the big piece of paper. That is the reason parachutes come down slowly. Air holds them up.

Experiment 5

What we did

We pressed a rubber dart from our gun game on a mirror, a piece of wood, or a piece of tin.

What happened

The rubber dart stuck to the glass, tin, or wood and we could pick it up.

What we learned

The air was pushing on the rubber so hard it stayed on the glass, wood, or tin.

Experiment 6

What we did

We put a candle in a saucer. We poured water in the saucer. We lighted the candle. We put a bottle over the candle.

What happened

Soon the candle went out and the water came up in the bottle.

What we found out

The lighted candle burned up all the oxygen in the bottle. When there was no exygen to push the water out of the bottle, the air on the outside of the bottle pushed down on the water in the saucer, and pushed the water into the bottle.

Along with our air pressure experiment we also siphoned water out of our aquarium. Of course the candle and water experiment brought up the question, "Why did the candle go out?" This led to the question—"Does fire need air to burn?" We did the following experiment to find out.

What we did

We stood a candle in a pan.

We lighted the candle.

We put a milk bottle over the candle.

What happened

Soon the candle went out.

What we learned

When the fire had used all the oxygen in the bottle it could not burn. It went out.

Fire needs oxygen to burn.

If we catch on fire or see a fire cover it so it cannot get any air.

We continued to find the answers to these questions about air by experiments.

IS AIR STRONG?

Experiment 1

What we did

We put a balloon under a book. We blew up the balloon.

What happened

The book was raised up as the air filled the balloon.

What we learned

Air is strong. Air can lift things. Air is used in machines to lift or raise things.

EXPERIMENT 2

We cut a small hole in a suit box. We squeezed the box and felt the air come through. We placed a lighted candle in front of the hole. We pressed the sides of the box again.

What happened

When the air came out of the box the flame moved.

IS AIR LIGHTER THAN WATER?

EXPERIMENT 1

What we did

We floated a balloon on a pan of water. We pushed the balloon down in the water. We took our hand away.

What happened

The balloon wouldn't stay down in the water.

EXPERIMENT 2

What we did

We blew through a straw into a glass of water.

What happened

Bubbles of air came to the top of the water.

By this time winter had arrived. One cold day when the children were getting ready for recess a child asked, "Do we need to wear our snow pants?" A discussion followed about temperatures and how to dress for different kinds of weather. This led to experiments with the thermometer. The children first learned what a thermometer was and how to read it. Several children brought thermometers to school so we observed many different kinds. One child brought an outdoor thermometer which our custodian fastened outside the window for us. Every morning a child was chosen to read the temperature in the room and outdoors. He reported it to the room and recorded it on a chart. The children compared the temperatures. They observed that the mercury or alcohol in the tube went up when the temperature was warmer and down when it was colder.

One day a child noticed that there was less water in the aquarium than there had been. We decided to find out the reason why by doing some experiments. By this time the children were becoming very observant. When something puzzled them they would say "Can't we find out by doing an experiment."

We took two small glasses the same size. We put the same amount of water in each one. We placed one glass in a warm place and the other one in a cooler place. We watched them for a few days. We observed a large amount of evaporation from the glass in the warm place and very little from the glass in the cooler place. From this experiment we learned that heat makes water evaporate and the warmer the temperature the quicker it evaporates.

Of course the children wanted to know where the water went. "Experiments" was the answer when I asked how we could find out. So we wet a bit of blackboard. We fanned the spot. Soon the blackboard was dry. We found out that wind helps water evaporate and the water had gone into the air. The children also learned the word "Evaporation."

Our next experiment was to observe two jars of water. The jars were the same size and held the same amount of water. We put a cover on one jar, the other one we left uncovered. Every day we looked at the jars. We found that the water in the uncovered bottle was evaporating. We learned air was needed to make water evaporate.

We took two pieces of cloth the same size. We wet both of them. We spread one out to dry, we left the other one rolled up in a ball. We observed them all day. The one that was spread out dried first. We found out that if more surface was exposed to the air evaporation was quicker. That is why on wash day Mother shakes out the clothes and hangs them up to dry.

Soon after this the snow fell in beautiful feathery flakes. I got a magnifying glass. We observed the beauty of the snowflake patterns and that no two snowflakes were

alike but that each one had six sides. When we came inside we made alum crystals. I told the children snow crystals were like alum crystals. They were told that snowflakes were drops of water that had turned to ice because of the intensely cold temperature.

To prove that water does turn to ice on a very cold day we placed a basin of water outdoors where we could watch it. A very thin layer of ice formed on top of the water at first, then gradually all the water turned to ice. I explained that that was the way ice formed on lakes. The ice forms on top first; that is why skaters sometimes break through and fall in the water underneath.

One child remarked his daddy put alcohol in his radiator so the water wouldn't freeze; another child told about the top on their milk bottles having been pushed up because the milk had frozen. I asked the children if they wanted to find out what would happen if water was put in a covered jar and put out in freezing temperature. Of course the answer was "yes." A cover was screwed tightly on a small jar of water and placed on the window sill. The children were very excited the next morning when they found the bottle had broken. They learned that water expands when it freezes. That was reason the jar broke.

The next day one boy brought a huge icicle which he had found on the way to school. I gave him a pan to put the icicle in until he went home. Later in the morning he exclaimed, "My icicle is gone, there is only water in the pan." The children decided that the heat of the room made the icicle melt and turn back to water.

I sent some of the children outdoors to fill a pan with snow, and bring it back to the room. In this way they could prove that water expanded when it froze and that heat turned ice or snow back to water. The pan was full of snow but when the snow had melted the pan was only half full of water.

When March came we talked about the wind and the wind's work. To learn that the wind is strong and has power to move things, we made pin-wheels. We took them outdoors on a windy day. The children had so much fun watching the wind turn the pin-wheels around.

We were very much interested one day when a rain-storm suddenly changed to a snow-storm. We observed how dark the sky was just before the storm. We concluded that rain and snow came from the clouds. To find out if our conclusion was correct and what rain really was, we did this experiment. We heated a tea kettle of water to the boiling point. A cloud of steam appeared near the spout. I held a cold pan near the steam. I showed the children the drops of water that had collected on the cold pan. The children learned that water evaporated into the air and helped make clouds. Many small clouds moved together to make large clouds of drops of water. When the clouds became too heavy with water it rained.

Many other things pertaining to science were discussed, many questions were asked and many other experiments were done.

VII. OTHER VISUAL-SENSORY AIDS THAT WERE USED

In addition to the experiments which we did various other visual-sensory aids and all the school subjects were utilized to teach the children many scientific facts.

I made story charts telling about each experiment which we did. These chart stories were mimeographed and put into booklets which each child made. Science books on the first and second grade level were placed in a convenient place in the library corner. The children were encouraged to find stories telling more about the experiments we had done or facts we had learned. Reading, spelling, and arithmetic were needed in keeping records. The children learned to count in finding how many days it took for the water in the jars to evaporate. They had to learn to count by twos to read the thermometer. They

needed to know how to read and write numbers to record the readings of the thermometer. They learned to tell time when observing how many hours it took for the cloth to dry in the evaporation experiment, how long it took the pan of water to freeze, and how many hours it took the snow to melt.

Oral and written language improved as the children talked and wrote about their activities. Their vocabularies were increased. Many of the new words they learned were introduced in their spelling lesson. Their writing improved as they wrote about their experiences.

During their art period they made pictures of the experiments for their booklets. Pictures showing a practical application of the facts they had learned were put up in the room.

The children found pictures in magazines depicting the practical application of scientific facts. These were put up on the bulletin board. Pictures and slides about ice and snow were borrowed from the Public Museum. The children enjoyed these very much.

The scientific facts learned were applied to healthful living. The children became more conscious of room temperatures. They learned what an ideal room temperature should be. They became observant of the weather and learned how to dress for all kinds of weather.

The facts they had learned carried over into their homes. They not only did the experiments at home but they also became observant of the things in their home that were practical applications of scientific principles they had learned about in school.

One day a little girl came to school and said, "My aunt has a big rubber cup with a handle on it just like the rubber target in our gun game. She cleans out the sink with it." We discussed how a plunger uses air pressure. The children expressed an appreciation for the modern conveniences in their home that science had provided.

Many children told of reading the weather reports in the paper, or listening to them over the radio. They checked these reports with the barometers they had made for themselves at home. They became weather conscious looking for signs and predicting a storm or fair weather.

VIII. THE OUTCOME OF THE SCIENCE ACTIVITY

Socially the children learned to be a little more considerate of each other. They learned to listen politely when others were talking. They worked together better in groups. As a group they became more alert and observant to things about them. They developed the habit of forming conclusions from facts they had learned instead of accepting anything that was told them or jumping at conclusions.

As I am writing this our science experiments are still being carried on. At the present time we are learning about germination of seeds and the need seeds and plants have for sun and rain to help them grow.

I have become convinced this year of the value of science experiences for young children. It seems too bad that so little has been done with science in the primary grades. I think science experiences are the best way of providing children with answers to their questions or with a means of getting the answers. Science information clarifies the mysteries of the elements, plants, stars, and animals. More than this, science is a thinking tool. It helps children to learn to observe evidence, and then to draw conclusions. It makes them aware of the importance of finding the facts rather than unquestioningly accepting everything they are told.

One must bear in mind when teaching science to children that discussion and story-telling do have their place, but science is definitely a visual-sensory subject. To get the most out of science a child must use his senses.

THE SCIENCE CONTENT OF BASIC READERS

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THE number of limiting factors that circumscribe the authors of basic readers is large. Within the confines of standard wordlists, experimentally-determined frequencies, children's interests, and artists' and typographers' limitations, there is little room to move about. To ask these authors to meet all these conditions of technical construction and also to ask them to adjust the child to his environment at the same time is perhaps too much. Yet there are some psychological reasons why the subject-matter of the basic reader is extremely important.

First, it is likely that many, if not most, of the children in the public schools get their first, most vivid, and major contact with the world of books when they read to improve the skills of reading. Practically every child reads his way systematically through some one series of basic readers. He *may* read other books, and often does. He *must* come into close contact with his reading-skills material. If we are to reach every young pupil in the school, it is probable that we must do it through the basic reading series.

Second, the mind that is learning to read, or to read more skilfully, is the impressionable mind of younger childhood. The whole world is unfolding, even exploding, unto the child, and he remembers, learns, and his attitudes are determined by those things which are pointed out to him by some agency. The repetitive nature of the material of readers, and the strangeness and fascination of the new doorway of books, help these basic readers to exert a strong influence on the personality of the child.

Third, not only does the vocabulary help fix pupils' interests, for all children delight in *naming* objects they have seen in their books, but the first bit of the *structure* of the environment is visible through the medium of the pages of the basic reader, and for the first time the child has his shy, half-formed questions answered without the intervention of the adult. He sees in the book a map of the world which he can read unaided and which he can take (inside his little head) out into his play-and-home environment to help him to interpret it better. That map should be reasonably complete and true to life if good emotional and social balance is to be the educational product for the child. This, then, is one responsibility of the author of the basic reader: to offer a well-balanced subject-matter content that will contribute to sane living, and that will not only be harmless but will help the teacher in achieving the socio-educational goals of the school system in a democracy.

These goals are, for the most part, admirably met by the basic-reader authors. They realize that children should learn about people, that schools must crowd many of the experiences that all humans have had into a short time so that we may go on from where the past leaves off; that it is important that we learn, through biography and history, how other people have lived and are now living, so that our economy and our social life may be understood; that it is important that the rules of conduct in a democracy be observed, so that these, together with worthy personal character, will ensure that we continue to produce good citizens and leaders. These are ponderous aims, fraught with responsibility, yet they are the aims of American education. They are probably the present reasons for the choice of much of the material of basic readers.

We find many stories of the farmer, and of those workers who produce the goods we use. Their way of life is presumably little known to many children (although the many stories of the farm must be read

by many farm-dwellers as well as by city children!) and so this area is a frequent topic for stories and expository treatment in the readers.

The normal desire for a pet, some soft and cuddly animal that will satisfy the child's desire for a personal friend, and will help fill an emotional need that all humans have, is apparent in almost every book for the younger child.

The aims and ideals of democratic living in the home, the school, and the community, are extremely important, and they are well-represented in most of our readers, so that from his first day in school the child sees the relationship of the family to himself, and of his family to the public servants such as the mailman, the postman, and the fireman.

The fanciful and whimsical heritage of literature is not neglected, and usually this area is definitely labeled by its structure as "for fun" and is not intended to teach directly, although it often does afford an insight into character-reactions that can be attained in no other way.

But there are only so many pages in a reader. If the map of the world that has been mentioned above is to be at all satisfactory and reasonably complete, it should neglect no area, should not be overbalanced with any one kind of material. It may be that this map could be made more complete and more accurate than it now is.

Children of today are growing up in a world of science that is both quantitatively and qualitatively different from that of their parents and that of the authors of the basic readers. Youngsters absorb the facts and the structure of this world by an almost imperceptible process something like osmosis. The radio, the advertisements, the comic books, the very roadsides, offer a multitude of facts and relationships that adults tend to overlook. They were not there when we were young and impressionable, and they are not perceptible to us now. This new world has left its mark on the child before he has left home for his first day of school; by middle elementary-school life it has influenced him remarkably. This world of electrical and mechanical marvels demands to be interpreted. If the arguments for stories of the farm, the postman, the conquest of the wilderness which have been given above are valid, then those arguments are also valid for the inclusion of this new world of science in the basic readers. The make-it-go, see-it-work elements are probably as strong as are any of the others we have considered.

The biological sciences and the purely physical sciences have not had their share of attention. True, there are superb supplementary science readers, many of which are extremely good reading for all readers from five to fifty, but these are simply not available to enough children, nor will they likely ever be, because of cost, lack of reading ability and interest, and the factor of "time" in the classroom.

Just how much *science* is there in the basic readers? Publishers of almost all the basic reader series sent books to the author for analysis during the summer of 1946. After discarding workbooks, teachers' manuals, and a few special readers in health and in problems of democracy, there remained 131 books, ranging in level from pre-primers to grade 6. One series ran through grades 7, 8, and 9, but had lost its vocabulary-control at grade 7 and could not properly be called a basic reader, so the three upper-grade books were omitted.

The check-list reproduced below was used to discover the science content. All books were read and evaluated solely by the author, although the method was taught to a group and some rough checks were obtained on the reliability of the evaluation. Some of the attitudes maintained by the reviewer are as follows: "science material" may be of two kinds; it may be a "pointing toward" the scientific environment so that attention is called to and fixes on the science aspect of an object or a situation, as when the *wheel* is noticed on the bicycle, or the telephone-man *tests* the telephone; or the structure and relationship of science

objects to each other and to the child is shown, as for example the tractor pulls the airplane down the runway, or the forest ranger uses chemicals to put out a small fire in the tent. "Science material" may be actual and complete science applications and bits of information that are frankly doing the task we are looking for; as, how does the radio station send out music, where do our metals come from, who invented the electric light. Excluded from consideration were pure geography, travel, and customs; personalization of animals and plants in the fairy-story style; and the home garden and household pets on the score that they were rarely considered in other than an informal way, with no emphasis on science applications. The pages mentioning wild and domestic animals from the standpoint of habits and characteristics were counted.

A page-by-page analysis was made, and pictures as well as text were counted. Questions, outlines, and reviews on science topics were also included in the total. The figures for science content, therefore, are *extremely generous.*

The following topics were listed:

Agriculture (not home gardens); Animals (not household pets); Rocks, soils,

TABLE I

TOTAL AND AVERAGE NUMBER OF PAGES FOR EACH GRADE-LEVEL OF 131 BASIC READERS, AND PERCENTAGES DEVOTED TO SCIENCE TOPICS

Grade	*Total Pages*	*Total Books*	*Average Number of Pages*	*Percentage Devoted to Science*
Pre-primer	831	16	51.9	14.3
Primer	1,916	15	127.7	13.3
Grade 1	3,536	24	147.3	12.8
Grade 2	4,738	21	225.6	19.1
Grade 3	5,124	18	284.7	19.4
Grade 4	3,709	10	370.9	18.1
Grade 5	7,128	17	419.2	19.1
Grade 6	4,604	10	460.4	15.0
All	31,586	131		16.5

TABLE II

PERCENTAGE OF TOTAL NUMBER OF PAGES, IN BASIC READERS, DEVOTED TO TOPICS IN SCIENCE

Science Topic	*Pre-Primer*	*Primer*	*Gr. 1*	*Gr. 2*	*Gr. 3*	*Gr. 4*	*Gr. 5*	*Gr. 6*	*For All Books***
Agriculture	1.0	t*	0.4	1.4	1.5	1.5	2.6	1.2	9.8
Animals	4.0	4.1	9.0	8.5	9.0	8.4	6.0	4.8	53.8
Rocks					t		2.0	0.7	2.7
Sky		0.5			0.4	0.4	t	1.4	2.7
Sun		t			t	t			0.3
Weather	t	1.0	t	t	0.8	t	t	t	2.4
Fire		0.7	t	1.0	0.4	0.4	t	0.4	3.0
Light			t	0.5	t	t	t		0.8
Food	1.0	1.4	t	2.6	0.4	0.4	t	t	5.9
Water	t	t		t			t	t	0.7
Clothing		0.5	t	1.0	0.8	0.5	t	t	3.1
Shelter	1.0	0.7	t	1.1	1.7	t	0.6	0.5	5.7
Transportation	5.0	2.8	3.2	1.8	3.3	3.6	2.6	3.0	25.3
Communication	t		t	t	0.5	0.4	t	0.4	1.8
Electricity					t	t	t		0.1
Chemistry				t	t	0.7	0.6	0.9	2.4

* *t* indicates less than 0.1 per cent (a trace).

** Note that these percentages are those fractions of the pages devoted to *science*, and are not fractions of all the reading matter.

mining, petroleum; The Sky at Night; The Sun; Weather; Air and Breathing; Home Heating; Fire (not home heating); Sound; Light (artificial); Food (not gardens); Water; Clothing; Shelter; Transportation; Communication; Mechanical Things; Electricity; Chemistry; and Miscellaneous.

As a concomitant study, three types of presentation were used as classification areas. "Narratives" were those areas that had a plot, however simple, although mere use of the names of the participants did not constitute a plot; "Exposition" was telling about something, and included processes or descriptions; "Experiments" were directions given to children to take part in some activity either in school or at home.

The three tables below are self-explanatory. So few pages on "Air and Breathing," "Home Heating," and "Sound" were found that these topics were not included in the final list.

The fact that only 73 pages, 0.2 per cent of the total of 31,586 pages in the 131 readers, needed to be classified under "Miscellaneous" speaks well for the choice of topics.

TABLE III

PERCENTAGE OF TOTAL PAGES IN 131 BASIC READERS DEVOTED TO VARIOUS TYPES OF PRESENTATION OF THE SCIENCE CONTENT

Type of Presentation	*Percentage*
Narrative	8.61
Exposition	7.90
Experiment	0.08
Total percentage of all pages devoted to science	16.59

Some interesting sidelights on the study were noted. In all the pages of all the books, the writer found but one error of scientific fact: Mother blew up three balloons, and tied strings to them. The next picture shows them floating indoors at the end of their strings. There were but 27 pages that suggested pupil activity. These were mostly in the form of simple experiments like watching seeds sprout, or observing ants or bees at work. There was one real joke: The pet-show at school was disrupted by fire. The firemen came, saved the kittens, the white mice, the puppies, the parrot, and the baby chicks. All were safe but the parrot. He was flat on his back. The firemen applied oxygen and artificial respiration, while all the children watched. Finally one of them remarked, "That parrot is stuffed." There was other humor, for example when Daddy fell out of the boat into two feet of water. He laughed first, so it was quite all right for the children to laugh, too.

Pictures were superb, almost without exception. They were timeless in the sense that costumes were not extreme, and should not cause the books to be out-of-date for a long time. The use of color is almost universal. One series of pictures on science topics in a 1945 book runs on almost every page as a frieze, and consists of clever little line drawings of all kinds of science subjects not necessarily connected with the immediate text. Another book has grand picture sections at the beginning of every chapter, again but casually connected with the reading material, but of intense scientific interest. There were many diagrams and simple, explanatory line drawings.

As was suggested at the beginning, there are so many factors to be considered in writing basic readers that criticism should proceed cautiously. Nevertheless, it is evident that there should be a more even distribution of emphasis among the various environmental interests. The very heavy loading in favor of the biological sciences, and especially for the habits and characteristics of animals, can hardly be justified except on sentimental grounds. Failure to acquaint the child with the fact that the sun is the source of all energy (and this concept was sought in vain, in any appreciable amount, in the sections on "agriculture") is deplorable. Light and sound should have been mentioned if only from the standpoint of care of the eyes and ears. Indeed, health preservation and safety are

conspicuous by their absence, and it would seem that lessons in these would be the concern of all writers for small children. A child who is unable to attend school because of preventable disease or accident is not going to learn to read anything, including health and safety stories later in his school life. This would mean more emphasis on weather, shelter, water, clothing, food, and fire. The books did lean heavily on transportation, but it was of the "let's ride or fly" variety. A grand opportunity to teach traffic safety was almost wholly ignored.

Children are interested in almost everything. It is reasonable to assume that they are interested in their science environment. From the standpoint of a science program, the material of the basic readers could as well be shifted in that direction as not, and that without losing any of the necessary social lessons which are now so well taught in basic readers.

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ABSTRACTS

Blough, Glenn O. "Why Science Study Is Important." *The Instructor* 66:37. September, 1947.

A study of science is important because it can be used to teach the elements of the scientific way of looking at things. Planned experiences are necessary if this method is to be made effective at all.

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The author states that "science in the elementary schools as it is now conceived by workers in the public schools is a development of the past two decades. As a newcomer with little or no established tradition and subject to extensive experimentation with children, science has been readily adaptable to the evolutionary changes in the elementary school. Today we find it accepted by administrators and teachers as an essential resource in the all around education of children."

Elementary science is designed for all children—not only those with exceptional ability in science. There is no dichotomy in the content and procedures in science instruction in education for social responsibility and life enrichment. Elementary science instruction needs to be well-balanced. The community is an essential resource but books, audio-visual materials, experiments are also very important. Extensive in-service programs are developing leadership among classroom teachers of science.

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Ideally a science laboratory should be provided in every elementary school. Often this is possible if the elementary teacher or teachers assume leadership in the development.

The article lists materials and supplies that an elementary science laboratory should have—the need of much storage space, a bulletin board, blackboard space, sink, running water, source of heat, filing cabinet, and experiment apparatus.

The elementary science center is a place where

pupils and teachers gain experiences, check tentative conclusions, find the answers to their questions.

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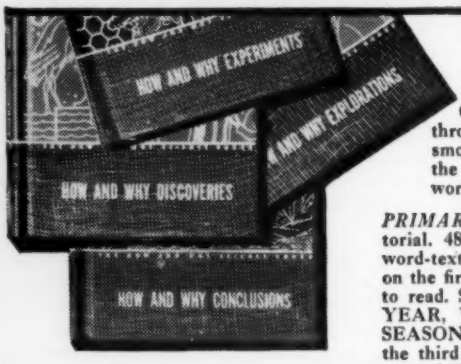
About a year ago Dr. Fred L. Whipple advanced the Dust Cloud theory. He believes the complete collapse of a stupendous cloud of cosmic dust and gas some 5,500,000,000,000 miles across, but of about the same mass as our sun today, was responsible for our solar system. Planets and sun were formed from the condensation of this cosmic dust substance. This all happened some two or three billion years ago according to this new theory. The new theory does not eliminate all of the objections to acceptance of other theories of earth origin.

THE REVISED HOW AND WHY SCIENCE BOOKS



WE SEE	Pre-primer
SUNSHINE AND RAIN	Primer
THROUGH THE YEAR	1
WINTER COMES AND GOES	2
THE SEASONS PASS	3
THE HOW AND WHY CLUB	4
HOW AND WHY EXPERIMENTS	5
HOW AND WHY DISCOVERIES	6
HOW AND WHY EXPLORATIONS	7
HOW AND WHY CONCLUSIONS	8

THE 1947 REVISIONS MAKE ELEMENTARY SCIENCE APPEALING AND EASY

Continuous science from kindergarten through grade 8, graphically presented in smooth sequence. . . . Visual education in the blending of accurate picture-text and word-text into one teaching medium.

PRIMARY. The pre-primer, WE SEE, is entirely pictorial. 48 pages of natural-color illustrations with no word-text enables the child to start the science program on the first day of the first grade, even before he learns to read. SUNSHINE AND RAIN, THROUGH THE YEAR, WINTER COMES AND GOES, and THE SEASONS PASS carry the seasonal arrangement through the third grade. Health, safety, and conservation round out a full science course.

INTERMEDIATE. Arranged topically, THE HOW AND WHY CLUB, HOW AND WHY EXPERIMENTS, and HOW AND WHY DISCOVERIES develop the program with such topics as aviation, the workshop, machines, sound, and other physical forces.

JUNIOR HIGH SCHOOL. Two new books have been added to the series — HOW AND WHY EXPLORATIONS and HOW AND WHY CONCLUSIONS. In clear, simple language and accurate illustrations, the easy-to-read format of the lower grade books is continued. Radio, atomic energy, metals, foods, engines, community health, and scientific war on disease are among the topics which will arouse and maintain the pupil's interest and foster scientific attitudes.

SUPPLEMENTARY MATERIAL. A teacher's manual for each grade; a workbook for each grade.

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BOOK REVIEWS

CRAIG, GERALD S., AND LEWIS, JUNE E. *Going Forward With Science.* Ginn and Company, 1947. 413 p. $1.50.

Book 7 of *Our World of Science* continues the series in the same interesting pattern of the earlier books. It begins with a treatment of pond life, explains how rocks are made under water, and how glaciers have moved rocks. It introduces the pupil to the wealth in the earth—salt deposits, beautiful minerals, ores, coal and oil, and gives a brief treatment of energy. Chemicals for the home, plastics and medicines give a practical slant to the subject. Light, color, and foods are applied to one's daily life. A jump off into the heavens gives a picture of our neighbors in space. We then come to plant life and plant enemies. Simple machines and electricity complete the chapters. Illustrations are both black and white, and color. The book is interesting and easy reading and should prove appealing to any child of seventh-grade age.

W. G. W.

CRAIG, GERALD S., AND URBAN, JOHN. *Science Plans for Tomorrow.* Ginn and Company, 1946. 448 p. $1.72.

In this, Book 8 of *Our World of Science*, the following topics are treated: The Story of the Stars, This Restless Earth, Understanding the Weather, The Balance of Life; Your Body at Work, Cooperation for Better Health; Making Current Electricity; Words, Wires and Waves; Travel in the Air Age; Science Helps the Farmer; and Science and America's Future. At the end of each section there are many suggestions under the headings: "Interesting Things to See" and "Interesting Science Experiences." Like its predecessors, this book is very well illustrated and will not fail to interest the Junior High boys and girls.

W. G. W.

FRASIER, GEORGE WILLARD, MACCRACKEN, HELEN DOLMAN, AND ARMSTRONG, LOIS GABEL. *We See; Sunshine and Rain; Through the Year; Winter Comes and Goes; The Seasons Pass; The How and Why Club; How and Why Experiments; How and Why Discoveries; How and Why Explorations; How and Why Conclusions.* Syracuse, New York: The L. W. Singer Company, 1947. 48, 96, 128, 224, 288, 352, 384, 384, 416, pages respectively. $0.40, $0.96, $1.04, $1.16, $1.28, $1.36, $1.44, $1.52, $1.64, and $1.76 respectively.

Most of these titles represent new books, but a few represent 1947 revisions. They constitute the *Scientific Living Series* and the *How and Why Science Series.* The titles are listed in grade placement order, the *We See* book being suitable for the kindergarten or first grade. It consists of a series of pictures in color, there being no textual material. The following book *Sunshine and Rain* has many pictures, all in color also, and in addition suitable reading material for the first grade. Especial attention has been paid to reading and vocabulary difficulties. Every book will appeal to children of that grade level. The stories and science material are well written. Children will enjoy the timely, interesting, challenging pictures in color. The books are attractively bound, each one partly in brown color and a second distinctive color unlike any other book of the series.

Based on readability, interest, attractiveness, selection of content, and pupil appeal, the series is entitled to wide usage. The reviewer would rank them among the top four series in elementary science.

C. M. P.

STEEL, MARY, AND HUDSPETH, JACK. *Do You Know?; Things Around Us.* Austin, Texas: The Steck Company, 1946 and 1947. 80 p. and 96 p. $0.32 each.

These are work texts in elementary science intended for the first and second grades respectively. The authors have done an unusually good job in these worktexts. The numerous illustrations by J. Robert Phillips add much to the "teachability" of the books and will appeal to children. The illustrations lend themselves to coloring by the pupils. The six parts of *Do You Know?* include: things around us, animals, weather, machines, health habits, and plants. The six parts of *Things Around Us* include: birds, the seasons, foods, magnets, insects, and what makes plants and animals grow. Teachers will like the suggested pupil activities and questions, regardless of whether or not each pupil has a copy of the worktext. A teacher's manual accompanies each worktext and is priced at ten cents.

C. M. P.

PARKER, BERTHA MORRIS. *Matter and Molecules.* Evanston, Illinois: Row, Peterson and Company, 1947. 36 p. $0.32.

This is the most recent of the numerous titles in the Basic Science Education Series. It is a teacher unit intended to serve as a basic background for teachers of elementary science who feel the need of more information about matter, molecules, and atoms. The information has been checked for scientific accuracy by Bryan F. Swan of the Laboratory School of the University of Chicago. There are illustrations in color as well as in black and white. Suggested experiments and demonstrations are included.

C. M. P.

FIEDLER, EVELYN A. *The World We Live In:* Book Four. Book Five. Book Six. Oklahoma City: Harlow Publishing Company, 1946, 1947. 104 p., 112 p.

These are a series of pupil workbooks in elementary science. They will serve a useful purpose for those teachers who use workbooks. For elementary science teachers who do not have their students use elementary science workbooks, there are many suggested experiments, activities, and observations. For this purpose the workbooks can be made to serve a most valuable function. The workbooks are divided into a series

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This general science book for the 9th grade:

- provides a scientific basis for intelligent thought and action on personal and social problems important to young people
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of units. A most helpful teacher's manual and key accompanies each workbook.

C. M. P.

FIEDLER, EVELYN A. *The World We Live In.* Book Seven. Oklahoma City, Oklahoma: Harlow Publishing Corporation, 1947. 112 p.

This is a science workbook for the seventh grade intended to be used with various textbooks. There are units on: Science and Scientists, Air and Its Uses, Water, Food and Diet, Physical Change and Chemical Change, The Nature of Living Things, How Man Makes His Work Easier, Modern Man and the Earth's Crust, and The Conservation of Human Life. A test on each unit is found near the back of the workbook. Many interesting experiments and activities are described. The use of a better quality of paper would have greatly improved the appearance of the workbook.

C. M. P.

SYMPOSIUM. *Science in Everyday Living.* New York: Jerome Metzner (55 Cooper Street), 1947.

Science in Everyday Living is the first of a new series of publications exploring the area of elementary science and its relationship to other areas of elementary education. It deals with two themes at the kindergarten—second year level: *Making Work Easy* and *Living Through the Seasons.*

Part I discusses four types of science experiences that generally occur in elementary teaching experience: (1) Incidental experiences, (2) Sequential experiences, (3) Science units, and (4) Integrative experiences.

The two units listed above are developed under the headings: Problems of Daily Living, Science Activities, and Developing Concepts.

Illustrations accompany the textual material.

Elementary science teachers at the kindergarten-primary level will find this a most useful publication.

C. M. P.

BEAUCHAMP, WILBUR L., WILLIAMS, MARY MELROSE, AND BLOUGH, GLENN O. *Discovering Our World.* Books One and Two. Chicago: Scott, Foresman and Company, 1947. 224 p.; 256 p. $1.48; $1.52.

The Scott, Foresman elementary science books have been among the leaders in their field for a long time. These two new editions assure the retention of that place of leadership. These latest *Discovering Our World* books are written directly to and for middle-grade boys and girls. Book One is for the fourth grade and Book Two is for the fifth grade. The language is simple, clear, and the numerous pictures, all in four colors, serve a definite teaching purpose along with the textual material.

The books are organized into units covering the broad aspects of everyday environment. As the emphasis is on "doing" as a means of learning, each unit has easy-to-perform experiments which are described and pictured. The acquirement of fundamental understandings and good thinking habits is stressed.

At the beginning of each unit is a list of things the pupil will learn. Pertinent questions are found among the textual material. At the end of each unit are found questions to answer and lists of things to do. The pictures are beautifully done and add much to the attractiveness and teachability of the books.

The units of Book One are: (1) How do living things help and harm each other? (2) What makes things move? (3) How is our work made easier? (4) How do heating and cooling change materials? (5) What are things made of? (6) How do we control fire? (7) Why do you need food? (8) Where does all of the food of the world come from? and (9) How can you make a garden?

Units in Book Two are: (1) How are the things of the world put in groups? (2) Why do living things need air and water? (3) How does your body work? (4) Why do we have days and nights? (5) What can we see in the sky at night? (6) What can magnets do? (7) How can we keep well? (8) How do animals and plants grow?

C. M. P.

BEAUCHAMP, WILBUR L., WILLIAMS, MARY MELROSE, AND BLOUGH, GLENN O. *Discovering Our World,* Book 3. Chicago: Scott, Foresman and Company, 1947. 304 p. $1.64.

This is the last of the *Discovering Our World* series of elementary science books for the intermediate grades. This book is for grade 6. It completes an unusually fine series of elementary science books for grades from the kindergarten to grade 6.

A multitude of real experiences in science are presented in such a way that children find out for themselves and thus develop scientific thinking skills. Boys and girls will enjoy doing the numerous science experiments. A wide variety of learning activities help youngsters find the answers to questions about the world in which they live. These questions, in the form of problems, are grouped in ten broad units each problem exploring some aspect of the unit problem. The ten units are: what makes sound? why does the weather change? how is the earth's surface changed? how do germs make you sick? how do we use electric current? how do we use light? what is the universe like? how do airplanes fly? where do new plants and animals come from? and what is the history of living things?

Particular attention has been paid to the vocabulary and new science words. All of the many challenging pictures are in four colors, each one intended to be used for a specific purpose in a great diversity of ways of teaching.

A Teachers Edition (at the same price) is a special boon to teachers having some misgivings about their competence to teach elementary science. Background material and specific techniques are presented for teaching each unit.

The authors are well known leaders in elementary science teaching. Dr. Beauchamp is professor of the teaching of science at the University of Chicago, Mrs. Williams is a former supervisor of elementary science in the Cleveland public schools, and Mr. Blough is specialist in elementary science in the U. S. Office of Education.

C. M. P.

SCHNEIDER, HERMAN AND NINA. *Now Try This.* New York: William R. Scott, Inc., 1947. 40 p. $1.50.

This is a second "Let's Find Out" picture-science book. The first 20 pages is devoted to "Drag It Along" discussion and experiments, the next 8 pages to "Lift It Up" and the last 12 pages to "Roll It Up" discussion and experiments. There are a total of 18 experiments. The experiments and textual material would seem to be quite suitable for the intermediate grades.

C. M. P.

WEBBER, IRMA E. *Anywhere In the World.* New York: William R. Scott, Inc., 1947. 64 p. $1.50.

This is the story of plant and animal adaptation. The story is suitable for upper primary grade level, although lower intermediate grade pupils will enjoy reading the book and looking at the illustrations. There are numerous illustrations in color by the author. These will be a joy to the child reading this book. This book is a fine addition to the authors earlier Travelers All—the story of how plants go places.

C. M. P.

IPCAR, DAHLOR. *Animal Hide and Seek.* New York: William R. Scott, Inc., 1947. Unpaged. $1.50.

This is the story of how animals hide themselves—through protective coloration. The book is about primary grade in difficulty. Illustrations, in colors, of plants and animals, show how the animals are able to hide so easily. Children will enjoy this book on animal coloration.

C. M. P.

SYMPOSIUM. *Good Health Is Good Business.* Washington, D. C. (800 21st St. N.W.): National Planning Association, 1948. 44 p. $0.25.

This is the summary of a technical study by a joint subcommittee on Health of the Agriculture, Business, and Labor Committeees of the NPA. There are five parts to the report: (1) Tuberculosis: Why Not Get Rid of It? (2) Deaths at Childbirth: Can't They Be Prevented? (3) Hospitals: How many, How Much, and For What? (4) Sanitation, and (5) Medical Care In Industry and Agriculture.

C. M. P.

HILL, KATHERINE ELIZABETH. *Children's Contributions in Science Discussions.* New York: Bureau of Publications, Teachers College, Columbia University, 1947. 96 p. $2.10.

This study presents a consideration of children's verbal responses in relation to certain objectives for science instruction in the elementary grades. The study tabulates in twelve categories the remarks made by children in Grades 1 through 6 during science discussions. The categories were accepted objectives for science instruction in the elementary school.

The study first gives some consideration to objectives in elementary science prior to 1925 and since that time. The discussion next centers around the school chosen for the study. The school selected had set up as its science objectives those earlier enumerated by Craig and in the Thirty-first Yearbook of the National Society for the Study of Education. The children involved ranged class size from 20 to 26 (a total of 143) and Median I.Q. range of 120 to 128. An elementary science program had been carried on in the school over a period of some years.

The categories or objectives under which the children's remarks were classified were: (1) Recognition and Identification of Natural Phenomena, (2) Inquiry, (3) Speculation, (4) Cause and Effect Relationships, (5) Conclusions, (6) Recognition of Achievement of Thinking, (7) Critical-mindedness, (8) Open-mindedness, (9) Responsibility and Cooperation, (10) Initiative, (11) Application of Experience, (12) Skills, (13) Miscellaneous. Children's remarks were recorded verbatim. Records were taken in each grade during sixteen consecutive periods in the fall and sixteen consecutive periods in the spring. Later 5 impartial judges classified the remarks under one of the above categories. A second method of collecting data was for the observer to classify each response by means of a code under one of the thirteen categories. Agreement between the judgments of the investigator and the five independent judges ranged from 83 to 90.

The pattern of total response did not differ greatly from grade to grade nor did the total number of responses. More responses were under some categories than under other categories. There seemed to be a recognizable difference between the remarks made by older children who had had more science experience, and those made by younger children who had had less science experience.

Altogether this is an outstanding research study, one of the very best studies that has been made in the science teaching field. Teachers interested in science education, curriculum construction, in child education, and in psychology will find this challenging and practical doctoral study meriting their serious consideration.

Note: A more detailed report of this study is reported by the author in the April issue of SCIENCE EDUCATION.

C. M. P.

HAUSMAN, ETHEL HINCKLEY. *Beginner's Guide to Wildflowers.* New York: G. P. Putnam's Sons, 1948. 375 p. $3.50.

Over 1,075 illustrations are included in this complete beginner's guide, said to have "more illustrations and descriptions than any other book for field use." There are individual drawings showing in detail the flower, leaf and stem of all wild flowers east of the Mississippi except very rare or very restricted species, and will be found useful as far as the Rocky Mountains and beyond, and in Canada. The author believes any beginner can easily and quickly find the name of any flower, without previous knowledge of botany.

All flowers are arranged according to their colors: white or whitish, yellow or orange, pink or red, blue or violet, green or brown. Usually three flowers are illustrated on each page. The text matter, close to the right or left of the flower picture, tells you about the color, size, taste, odor, whether the plant is sticky or hairy or smooth, places where the plant is usually grown, its geographical range, time of blooming, and the common and scientific names.

This would seem to be an unusually fine guide for elementary science teachers, general science teachers, the novice in flower identification, and even for the better trained high school biology teacher.

C. M. P.

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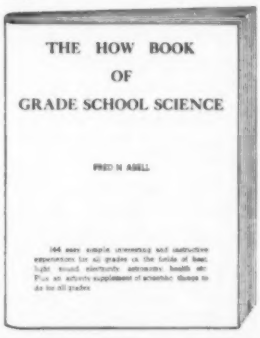

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HEIMERS, LILI. *Free Teaching Aids.* Upper Montclair, New Jersey: New Jersey State Teachers College, 1948. 53 p. $1.00.

Free teaching aids in 14 subjects are listed. Over 250 addresses from which may be obtained free charts and maps, publications and pictures, useful to teachers of all age groups, are listed.

The fourteen subjects include: agriculture, art, banks and banking, business education, conservation, consumer education, guidance, home economics, languages, mathematics, music, practical arts, safety education and sports and recreation.

Both elementary and secondary teachers will find much useful material listed, available for the asking.

Note: In ordering, remittance (no stamps) must accompany the order.

C. M. P.

ZOFF, OTTO. *Riddles Around the World.* New York: Pantheon Books, Inc., 41 Washington Square, 1945. 66 p. $2.00.

The book contains sixty-three riddles and oftentimes an illustration represents a word so you have to guess the word. At the end of the book the riddle is again repeated and the correct answer to the riddle given there. The illustrations are in color and were done by F. Kredel.

F. M. D.

SYMPOSIUM. *Science Creates a Modern Industry.* New York (299 Madison Avenue): Sally Dickson Associates, 1947. Free.

This is an illustrated science unit prepared by the American Viscose Corporation. General science, elementary science and chemistry teachers and students will find the unit quite useful.

R. J. A.

PAGE, IRENE F. (Editor). *Big Book for Special Days.* Chicago: Beckley-Cardy Company, 1947. 248 p. $2.00.

This is a collection of original plays and poems. Some have a science slant such as the harvest moon, friendly pumpkins, wild flowers, forsythia, violets, and duck pond. R. J. A.

SYMPOSIUM. *A Report to Educators on Teaching Films Survey.* New York: Harper and Brothers, 1948. 117 p. Free.

This study was made through the cooperation of seven publishers: Harper and Brothers; the Macmillan Company; Harcourt, Brace and Company; Henry Holt and Company; Scott, Foresman and Company; Houghton Mifflin Company; and Scholastic Magazines. Several thousand school administrators cooperated.

The purpose of the study was "to evaluate the effectiveness of the visual aids now available and to explore more fully the possibilities of correlation between film production and textbook publication.

An extensive survey was carried out under the direction of Carroll Y. Belknap. Through questionnaires and personal interviews much information was obtained regarding the present status and usefulness of teaching films. Many films were evaluated. Three films were produced by the cooperating companies. The three films were: Osmosis, The Seasons, and Borrowing in Subtraction.

An extensive digest of the Belknap report is included. The report lists five types of motion pictures as most educationally effective: films whose principal aim is to develop social attitudes, films dealing with specific vocational skills, films designed to stimulate interest in specific subjects in the curriculum, films designed to provide background for understanding of school subjects, and films designed to teach specific parts of subjects in the curriculum. Grade teachers agree that background films are most educationally effective, followed by social-attitude films.

The Belknap report warned the publishers against undue optimism regarding publishers' successful cooperation in producing school films. The report gave neither a red nor a green light, but rather a caution signal. The report suggests deferment until a time when a wider market may offer better opportunity.

This detailed report will have great significance for many American educators. Its data and conclusions will be widely and long discussed, possibly both pro and con. Its implications will be difficult to refute.

C. M. P.

SYMPOSIUM. *Extended School Services Through the All-Day Neighborhood Schools.* Brooklyn (110 Livingston St.): Board of Education of the City of New York, 1948. 86 p.

The All Day Neighborhood School Plan developed from an idea first put into practice in Public School 33 (Chelsea) in 1936. Since that time it has been greatly expanded. It emphasizes vital learning experiences, social relationships, and the inter-relation of home and school. The school day has been extended into an after-school program of varied related activities, and closer home-school-neighborhood relationships have been developed.

C. M. P.

CARROLL, FRANKLIN B. *Understanding Our Environment; Understanding Our World; Understanding the Universe.* Philadelphia: The John C. Winston Company, 1947. 313 p. 412 p. 550 p.

This is a three volume *Interpreting Science Series* intended for the seventh, eighth, and ninth grades. The author is head of the science department of the Frankford High School, Philadelphia, and was one of the co-authors of an earlier science book with Weed and Rexford.

This series is not a revision of this earlier series but an entirely new series. According to the author "the aim of this series of textbooks is the introduction of the pupil to intelligent participation in a world dominated by science. The pupil's participation is immediate, not at some remote date. Attention is directed to the present surroundings, and the science is developed from

the experiences of the pupil. The series attempts to use as points of departure the interest displayed in actual classroom experience as well as out of school. The method of science is kept constantly before the pupil's attention. Establishment of facts through observation is presented in experimental studies as well as through text and narrative. Recurrence of facts throughout the series and within the book provides opportunity for amendment and expansion of concepts."

"Procedure and terminology have been reduced to simple terms. Experiments and observations are kept within the grasp of pupils of the grade. Experiments require as little apparatus as possible. Ample provision is made for more extensive work by capable students."

Such are the author's lofty aims for the series. In the opinion of the reviewer, "marked success" will be the final rating of the pupils and teachers using the series. The books are bound in attractive, durable covers, the paper is of excellent quality and non-glaring. The general appearance of the pages is very satisfactory, and the illustrations, and the photographs, many in color, seem to be well-selected. They should appeal to the boy or girl reading the text. At the end of each chapter are pupil suggestions for studying the chapter, investigations, suggested projects, activities, and a self-test. Numerous pupil experiments are also listed in these pupil suggestions and really should form a most important part of the chapter.

Unit headings are as follows: *Understanding Our Environment* (1) what is science? (2) what is around us? (3) how wild things prepare for winter, (4) water, (5) rocks and soil, (6) air, (7) fire, (8) health, (9) when spring comes, and (10) conservation of natural resources; *Understanding Our World* (1) how living things fit into the earth, (2) astronomy, (3) weather and climate, (4) water, (5) some plants and animals of the house and garden, (6) health, (7) energy around us, (8) heat in the world, (9) magnetism and electrical energy, (10) making work easier, and (11) the changing earth; *Understanding the Universe,* (1) the air—how it controls us and how we control it, (2) water: how science has forced it to serve, (3) what things are made of: matter, (4) the power to do things: energy, (5) heat energy, (6) sound, (7) light, (8) electricity and magnetism, (9) living things, (10) field and forest in the service of man, (11) the science of keeping fit, (12) how we control and use the microscopic world, (13) the changing balance of nature, (14) earth science, (15) what determines the weather, and (16) our place in the sky.

Both pupils and teachers will find this a most attractive series, deserving of a place among the best general science textbooks that have been published. Both pupil appeal and teachability should assure the series of both extensive and long usage.

C. M. P.

Martin, Alexander C. *Botany and Our Social Economy.* Boston (20 Spruce St.): National Wildlife Federation, 1948. 30 p. $0.10.

The volume discusses the importance of plants in today's world, their marked depletion, natural and human barriers to their restoration, and the responsibilities of educators in assuring a decent supply of natural resources for tomorrow's generation. The author relates science to society, and vice versa.

This publication will be useful to teachers of elementary science, biology, general science, geography, conservation, and social studies.

C. M. P.

Mason, Miriam E. *A Lion for Patsy.* Philadelphia, Washington Square: David McKay Company, 1947. 32 p. $1.50.

Patsy lived in a large city apartment where no pet animals were permitted. She saw a movie where a jungle queen was shown with lions. The little girl longed to own a pet lion. A visit to the zoo convinced her they were too large, had too large teeth, and were too dangerous for a pet for a little girl. But she captured a furry "something" which turned out to be a caterpillar and she kept it in her home. She saw it change into a cocoon and it lay dormant all fall and winter. In the spring she had the pleasure of owning a beautiful moth which she turned out into the spring air and sunshine, to go free among all the other happy creatures with wings. This book is about first- and second-grade level.

F. M. D.

Knight, Clayton. *The Aviator.* Philadelphia, Washington Square: David McKay Company, 1947. 35 p. $.75.

Bill, the pilot, gives a small boy some facts about flying while he is on a plane trip to Florida. This is a small book on first and second grade level.

F. M. D.

Cridland, Margery. *The Baker.* Philadelphia, Washington Square: David McKay Company, 1947. 35 p. $0.75.

The story of wheat and bread is told in words and colored pictures that will appeal to first and second grade children.

F. M. D.

Horowitz, Caroline, and Hart, Harold. *The Big Good Time Book.* New York: Hart Publishing Company, 1947. 192 p. $1.50.

The book has been prepared for boys and girls 7 to 10, but older brothers and sisters will enjoy the book as well. The book will help to make the child more alert and there are puzzles to solve and riddles to answer. Poems and carefully selected stories are sandwiched in among pencil games, party games, word games and lessons in cartooning. Quizzes of various types test both general and specific knowledge. It is said of the book that children like the book and remain glued to it in ecstatic attention for hours on end.

The pictures and illustrations alone are worth all the book costs. It is the ideal "fun book" of the year for the 7 to 10 year oldsters.

F. M. D.

HOROWITZ, CAROLINE, AND HOROWITZ, JUDITH. *The Great Big Happy Book.* New York: The Hart Publishing Company, 1947. 120 p. $1.50.

There are times when a nice book and some adult member of the family to read to a child makes for some of his happiest moments. This book is designed for the pre-school child, ages 3–7. Nothing is to be marked or colored but there are action songs, action games, funny poems, picture poems and play activities and tests which help to make the child more observant and alert to his physical and social environment. The book is attractively illustrated in color. It comes in a pink paper binding and has a happy-face boy-girl jacket which will appeal to Mary and John.

F. M. D.

HOROWITZ, CAROLINE. *A Treasury of Play Ideas for Tiny Tots.* New York: Hart Publishing Company, 1947. 96 p. $1.00.

All sorts of play ideas suitable for the pre-kindergarten and kindergarten child.

F. M. D.

BARROWS, HARLAN H., PARKER, EDITH PUTNAM, AND SORENSEN, CLARENCE WOODROW. *The American Continents.* New York: Silver Burdett Company, 1946. 314 p. $2.24.

This is the second textbook in the series and it is to be used in the fifth grade. About half the book is devoted to the United States and the second half to Canada and Latin America. The authors in writing this textbook recognized that ideas are more important than facts, but that sane and useful ideas must spring from consideration of relevant facts. Careful selections of material were made. In the back of the book is an index and information as to area and population which will be of great interest to teacher and pupil.

F. M. D.

BARROWS, HARLAN H., PARKER, EDITH PUTNAM, AND SORENSEN, CLARENCE WOODROW. *Old World Lands.* New York: Silver Burdett Company, 1947. 346 p. $1.80.

This is the last of a series of three geography textbooks and it is designed for use in the sixth grade. *Our Big World* in the fourth grade and *The American Continents* in the fifth grade precede it. *Old World Lands* deals with the peoples and countries of Europe, Asia, Africa and Australia. The drawings and pictures are an integral part of the descriptions of peoples and places. They should help greatly to produce distinct and lifelike images in the minds of the pupils. Excellent tables of statistics as to population and area are found in the back of the text along with a complete index.

F. M. D.

BARROWS, HARLAN H., PARKER, EDITH PUTNAM, AND SORENSEN, CLARENCE WOODROW. *Our Big World.* New York: Silver Burdett Company, 1946. 186 p. $2.40.

This is the first of three textbooks designed as the basis for a unified course in elementary geography. The fate of a democracy depends on an enlightened public opinion. This "global geography. The fate of a democracy depends on American children about other peoples of the world. Fourth grade children will be able to read the textbook readily and it provides simple lessons in map reading. It contains twenty-five actual globe photographs of a novel type, nineteen of them colored.

There is a workbook for pupils as a companion to *Our Big World.* There are helpful suggestions for both teacher and pupil at the end of each chapter. Iceland, Norway, Holland, Switzerland, Mediterranean countries, Egypt, the Congo region of Africa, Australia and Alaska are studied and comparisons are made between their homeland and that of the United States.

F. M. D.

ZIM, HERBERT S. *Rabbits.* New York: William Morrow and Company, 1948. $2.00.

Here is a charming looking little book that is, in fact, a reference manual weighted with facts and facts about rabbitdom. All kinds of information fills these lovely looking pages—what kinds of rabbits and hares there are, where they live, what they eat, what they look like, how they hop, who their enemies are, what rabbits are used for, with a whole section devoted to the care and raising of rabbits.

The elementary science teacher might profit by using this material as a motivation and a guide in project work. The section on the details of rabbit care is especially useful along this line.

However, this rich little book presents an anomaly in that its subject matter is too advanced for its clothes. Beautiful illustrations grace every page. The baby blue coloring and large print, the unassuming title, *Rabbits*, the simplicity of format indicate a delightful story book about the hero of many a children's fairy tale. But the unsuspecting mother of a four year old will be most astonished at this "bed time story" for her youngster.

The toddler set, whom the baby blue coloring would attract, would be quite the wrong readers for such details as the list of long names of various kinds of rabbits, the ten year cycle in rabbit population, the discussion of the rabbit's enemies waxing fat as the ten year cycle reaches its climax. Such information as this book offers has its most valuable service in the motivation and guidance of school project work. *Rabbits* might also seek its place in a well-rounded juvenile collection for the older child interested in the world around him. It still remains questionable whether such a child would be attracted or repelled by the oversimplicity of appearance.

ROSE SHERMER